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**Verbs of creation**


1 Introduction

**Verbs of creation** denote the coming into being of the referent of their direct internal argument as a result of the event named by them. Such verbs are therefore often said to take ‘effected objects’.

Examples in which the entity created is a physical object:

(1)  
(a) Rebecca built a Victorian style house.  
(b) Sarah compiled a program written in Scheme.  
(c) Daniel made a Caesar salad for dinner.  
(d) Rebecca drew a right triangle.  
(e) Sarah painted a picture of the Hungarian parliament building.  
(f) Daniel wrote a paper on verbs of creation.

The characterization is intended to cover so-called performance verbs as well, though in this case the entities created are events (namely, performances) and not physical objects:

(2)  
(a) Rebecca said a prayer for dinner.  
(b) Sarah sang a sad song.  
(c) Daniel recited a poem by E. E. Cummings.

In (2), the events described by the verbs are themselves the performances created, but the performances count as instances of the entities named by the object noun phrases.

The characterization accommodates also verbs whose internal argument denotes an abstract entity that intuitively comes into being as a result of the event in question:

(3)  
(a) Rebecca composed a symphony.  
(b) Sarah designed a Victorian style house.  
(c) Daniel invented a new salad.

Such entities are minimally physically represented in the brains of their respective creators immediately following the corresponding creation events.

The main condition for abstract entities which are created is that they be represented in some physical medium, for otherwise it would be unclear what their ‘coming into being’ amounts to.

2 Verbs of creation fall into three subclasses, depending on the semantic character of their direct internal argument:

- verbs denoting the creation of a physical object,
- verbs denoting the creation of an event (henceforth, ‘performance verbs of creation’), and
- verbs denoting the creation of an abstract entity.

Since physical objects and events are both concrete entities, the first two subclasses form a natural subclass against the subclass of verbs denoting the creation of an abstract entity.

A verb can belong to more than one subclass.

Verbs like build and make can have a reading on which their internal argument refers to an abstract entity:

(4)  
(a) Rebecca built a Victorian style house that Sarah designed.  
(b) Sarah designed a Victorian style house. Rebecca built it.

(5)  
(a) Sarah made a new salad that Daniel invented.  
(b) Daniel invented a new salad. Sarah made it.

Such verbs are ambiguous with respect to the character of their internal argument (physical object vs. abstract entity); the two meanings in question are intimately related, and any analysis should make this explicit, especially because on both readings a physical object is created.

Performance verbs of creation may take an abstract entity as their internal argument (cf. also 2c):

(6)  
(a) Rebecca said a prayer for dinner that Sarah wrote.  
(b) Sarah wrote a prayer for dinner. Rebecca said it.

(7)  
(a) Daniel played a piece for the piano that Rebecca composed.  
(b) Rebecca composed a piece for the piano. Daniel played it.

A reasonable conjecture: If a performance verb of creation heads a clause that is aspectually an accomplishment (which is the intended reading of the sentences in (2) and (6)–(7)), then its internal argument denotes an abstract entity.

2 Creating physical objects

2.1 The model structure

The semantic analysis in section 2.2 will be formulated with the help of a standard higher order extensional type theoretical language \( L \), with lambda abstraction, identity, and the iota operator.

A model for \( L \) is a pair \( M = (S, \iota) \), where \( S \) is a model structure and \( \iota \) is an interpretation function.
S is a tuple
\[ \langle D, O, E, T, \prec, \prec', \text{trace}, \text{exist}, d_0 \rangle, \]
where D, O, E, and T are nonempty sets of individuals, \( \prec, \prec' \), trace, and exist are distinguished relations on one or more of these sets, and \( d_0 \) is a special nil individual in D.

The sets O, E, and T are pairwise disjoint and each forms a subset of D. O is a set of physical objects, E is a set of events, and T is a set of times. There are sorted variables for the elements of each of these three domains:

(8) \[ O: x, y, z, \ldots \quad (\text{physical objects}) \]
\[ E: e, e', e'', \ldots \quad (\text{events}) \]
\[ T: t, t', t'', \ldots \quad (\text{times}) \]

E includes states as well as events proper, and T comprises both instants and intervals.

The unsorted variables \( a, b, c, \ldots \) range over the elements of D.

The relation \( \prec \) on \( D \times D \) is a mereological relation of proper part (\( a \prec b \) ‘\( a \) is a proper part of \( b \)’).

It is a strict partial order (i.e., irreflexive, asymmetric, and transitive), and the following notions are based on it and identity (in (9c), \( P \) is a one-place predicate with an extension in D):

(9) \[ (a) \quad a \leq b =_{at} a \prec b \vee a = b \quad (a \text{ is a part of } b) \]
\[ (b) \quad a \ast b =_{at} \exists c [c \leq a \land c \leq b] \quad (a \text{ and } b \text{ overlap}) \]
\[ (c) \quad \text{sum}(a, P) =_{at} \forall b [b \ast a \leftrightarrow \exists c[P(c) \land c \leq b]] \quad (a \text{ is a sum of } P) \]

The overlap relation (‘Überlappen’) in (9b) allows the following principle for proper part to be stated more compactly:

(10) \[ \text{Axiom. } \forall a \forall b [a \prec b \rightarrow \exists c[c \prec b \lor -(c \ast a)]] \quad (\text{one proper part implies another}) \]

This axiom excludes the possibility that an individual has a single proper part.

The sum relation in (9c) is demonstrably functional with respect to its individual argument:

(11) \[ \text{Fact. } \forall a \forall b \forall P [\text{sum}(a, P) \land \text{sum}(b, P) \rightarrow a = b] \quad (\text{uniqueness of sums}) \]

This fact allows us to introduce iota terms for sums in case they exist:

(12) \[ \sigma(P) =_{at} \mu[\text{sum}(a, P)] \quad (\text{the sum of } P) \]

A special case of sum is when two individuals are summed:

(13) \[ a \ast b =_{at} \sigma(\lambda[c \leq a \lor c \leq b]) \quad (\text{the sum of } a \text{ and } b) \]

The final mereological principle guarantees the existence of sums whenever the extension of \( P \) is nonempty:

(14) \[ \text{Axiom. } \exists a[P(a)] \rightarrow \exists a[\text{sum}(a, P)] \quad (\text{existence of sums}) \]

This axiom has the consequence that \( D \) also includes ‘mixed’ individuals such as sums of physical objects and events and sums of events and times.

Letting \( [X]T \) designate the closure (‘Abschluss’) of \( X \) under the sum operation, for a given set \( X \), we now postulate that the closure of the union of O, E, and \( [d_0] \) under the sum operation is a subset of \( D \):

(15) \[ \text{Axiom. } [O \cup E \cup T \cup [d_0]]T \subseteq D \quad (D \text{ contains the closure of the union of } O, E, \text{ and } [d_0] \text{ under sums}) \]

The relation \( \prec \) is temporal precedence, which is a strict partial order on \( [E \cup T]T \times [E \cup T]T \) i.e., a two-place irreflexive, asymmetric, and transitive relation on the closure of \( E \cup T \) under the sum operation.

Sorted variables for the elements of \( [E \cup T]T \) (temporal individuals, i.e., events or times or any of their sums):

(16) \[ [E \cup T]T: s, s', s'', \ldots \quad (\text{temporal individuals}) \]

The following principle states that temporal precedence (\( s \prec s' \)) is incompatible with overlap:

(17) \[ \text{Axiom. } \forall s \forall s' [s \prec s' \rightarrow -(s \ast s')] \quad (\text{temporal precedence excludes overlap}) \]

In contrast to \( O \) and \( E \), \( T \) has a linear structure, which means that any two times either stand in the precedence relation or overlap:

(18) \[ \text{Axiom. } \forall t \forall t'[t \prec t' \lor t' \prec t \lor t = t'] \quad (\text{linearity of times}) \]

Instants are times without proper parts:

(19) \[ \text{instant}(t) =_{at} \neg \exists t'[t' \prec t] \quad (\text{instant}) \]

The relation trace on \( T \times [E \cup T]T \) is postulated to be functional with respect to its time argument, as stated in (20a), and supplies the time (or temporal trace) of a temporal individual (trace\( t \), s) \( t \) is the temporal trace of \( s \).

The time of a time is simply that time, as postulated in (20b).

(20) \[ \text{Axiom. } \forall t \forall t' \forall s [(\text{trace}(t, s) \land \text{trace}(t', s)) \rightarrow t = t'] \quad (\text{uniqueness of temporal traces}) \]
\[ \text{Axiom. } \forall t \forall s[\text{trace}(t, s)] \quad (\text{the temporal trace of a time is that time}) \]
Given the functionality of trace with respect to its time argument, we may speak of the temporal trace of a temporal individual:

\[ \tau(s) = \omega M[\text{trace}(t, s)] \] (the time of an event or a time)

Axioms for \( \tau \):

\[ \begin{align*}
(21) & \quad \tau(s) = \omega M[\text{trace}(t, s)] \\
(22) & \quad \text{Axiom. } \forall s \forall s' \left[ \tau(s) = \tau(s') \right] \\
& \text{Axiom. } \forall s \forall s' \left[ s < s' \rightarrow \tau(s) < \tau(s') \right]
\end{align*} \]

The semantics for the iota operator fail to be defined. A Fregean strategy: Postulate a nil individual \( \underline{d}_0 \) as the denotation of such undefined descriptions (= a technical convenience that enables \( L \) to remain bivalent).

The semantics for the iota operator:

\[ \begin{align*}
(26) & \quad \llbracket \underline{d}_0 \rrbracket_M = \underline{d}_0 \\
& \text{A temporal individual exists at a time just in case the value of } \tau \text{ applied to it is that time—in this sense, a temporal individual has its time of existence built into it.}
\end{align*} \]
2.2 The semantic analysis, I

With Lc, we can turn to the analysis of verbs denoting the creation of a physical object.

All of these verbs share a thematic relation on \( E \times O \) as their common core of meaning. Four properties that a thematic relation may have (cf. Krifka 1989, 1992):

A thematic relation \( R \) satisfies the property **uniqueness of physical objects** just in case it is functional with respect to its physical object argument:

\[
(31) \quad (a) \text{UNI-O}(R) = \text{ad} \forall e \forall e' \forall y \left[ (R(e, x) \land R(e', y)) \rightarrow e = y \right] \\
(R \text{ satisfies uniqueness of physical objects})
\]

Thematic uniqueness: the thematic role in question may be assigned to at most one argument.

The relation \( R \) satisfies the property **uniqueness of events** just in case it is functional with respect to its event argument:

\[
(31) \quad (b) \text{UNI-E}(R) = \text{ad} \forall e \forall e' \forall x \left[ (R(e, x) \land R(e', x)) \rightarrow e = e' \right] \\
(R \text{ satisfies uniqueness of events})
\]

This in turn encodes a prohibition against iterativity: the physical object may stand in this relation at most once to a event.

The relation \( R \) satisfies the property **weak mapping to physical objects** just in case any subevent of its event argument \( e \) is a part of a subevent of \( e' \) that stands in the relation \( R \) to a part of the physical object argument \( x \):

\[
(32) \quad (a) \text{WMAP-O}(R) = \text{ad} \forall e \forall e' \forall x \forall y \left[ (R(e, x) \land e' \leq e) \rightarrow \exists e'' \exists e''' [e'' \leq e''' \land e''' \leq e' \land y \leq x \land R(e'', y)] \right] \\
(R \text{ satisfies weak mapping to physical objects})
\]

Notice that this property does not require every subevent of \( e \) to be mapped to a part of \( x \), but only that every subevent of \( e \) be covered by such a mapping.

The converse of this property is **weak mapping to events**, which is fulfilled by \( R \) only if any part of its physical object argument \( x \) is a part of a part of \( x \) that stands in the relation \( R \) to a subevent of the event argument of \( R \):

\[
(32) \quad (b) \text{WMAP-E}(R) = \text{ad} \forall e \forall x \forall y \left[ (R(e, x) \land y \leq x) \rightarrow \exists e' [y \leq z \land z \leq e \land R(e', z)] \right] \\
(R \text{ satisfies weak mapping to events})
\]

As before, this does not require every part of \( x \) to be mapped to a part of \( e \), but only that every part of \( x \) be included in such a mapping.

The four properties in (31) and (32) capture a sense in which a physical object may participate incrementally in an event:

Introduction of a particular thematic relation incremental that is postulated to have these properties:

\[
(33) \quad \text{Axiom. UNI-O(incremental) \land UNI-E(incremental) \land WMAP-O(incremental)} \\
\quad \land WMAP-E(incremental) \\
\text{(incremental satisfies the four properties in (31) and (32))}
\]

The thematic relation **created** is a tensed version of incremental that requires the physical object to exist at the end of the event in question and at no time during the event before its end:

\[
(34) \quad \text{created}(e, x) = \text{ad} \forall e' [\text{incremental}(e, x) \land \text{exist}(e', x)] \\
\quad \land \forall t \exists_1 \tau(t \leq \tau(e) \land t < \tau(e) \\
\quad \rightarrow \text{exist}(t, x)] \\
(\text{x is created in e})
\]

created inherits the four thematic properties of incremental:

\[
(35) \quad \text{Fact. UNI-O(created) \land UNI-E(created) \land WMAP-O(created)} \\
\land WMAP-E(created) \\
\text{(created satisfies the four properties in (31) and (32))}
\]

The common meaning component of verbs denoting the creation of a physical object is precisely the relation **created**.

Example: Analysis of sentence in (1a) (using Kratzer’s 1996 proposal)

\[
(36) \quad (a) \text{build } \lambda y \lambda x [\text{build}(e) \land \text{created}(e, y)] \\
(b) \text{AGENT } \lambda y \lambda x [\text{AGENT}(e, x) \\
(c) \text{a Victorian style house } \rightarrow \lambda y \lambda x \exists_1 [y \leq \tau(e, y) \land \text{victorian-style-house}(y)] \\
(d) \text{Rebecca } \rightarrow \text{rebecca}
\]

Schematic syntactic structure indicated in (37a), its corresponding event predicate is shown in (37b), which is the straightforward result of type-driven functional application:

\[
(37) \quad (a) \left[ (\text{Rebecca}) [\text{AGENT} (\text{build} (\text{a Victorian style house}))] \\
(b) \lambda c \exists y [\text{build}(e) \land \text{created}(e, y) \land \text{victorian-style-house}(y) \land \text{AGENT}(e, c, \text{rebecca})]
\]

Cf. text, p.11
The event predicate in (37b) is demonstrably quantized (which is characteristic of accomplishments).

Quantized reference for one-place predicates of individuals is defined in (38a), and the corresponding result for the event predicate in (37b) is given in (38b).

(38) (a) \( \text{QUA}(P) = \text{def} P(a) \land b < a \rightarrow \neg \text{P}(b) \)  

(The proof makes use of uniqueness of objects, uniqueness of events, weak mapping to objects, and of course the fact that victorian-style-house is quantized. Compare Krifka 1992, T11, p. 41).

(b) Fact. \( \text{QUA} \exists! e \left[ \exists y \left( \text{build}(e) \land \text{created}(e, y) \land \text{victorian-style-house}(y) \right) \land \text{agent}(e, \text{rebecca}) \right] \)  

(the event predicate in (37b) is quantized)

3 Creating events and templates

A treatment of performance verbs of creation and those denoting the creation of an abstract individual.

3.1 Extending \( L_c \) to \( L_{ce} \)

Cf. text, pp.12-13

The relation between the physical house and the abstract house design (i.e. a house template) is one of instantiation, symbolized as \( \triangleright x \). The relation between the architectural house plan and the abstract house design is one of representation, symbolized as \( \Rightarrow y \Rightarrow x \) (‘\( y \) represents \( x \)).

Both of these relations are irreflexive, asymmetric, and intransitive.

Definition of a notion of derivative instantiation, designated by \( \triangleright^* \), which relates the physical house to the architectural house plan, \( x \triangleright^* y \) (‘\( x \) derivatively instantiates \( y \)).

Cf. text, p.13
A concrete individual may be (in fact, usually is) more detailed than an abstract individual that it 
instantiates, provided that its extra detail does not conflict with the information that the abstract 
individual specifies.

This permits a concrete individual to instantiate many different abstract individuals, where the 
latter differ from each other according to the information (greater or less detail) that they specify.

In contrast, the relation of representation as construed here is much less liberal and requires a 
tight fit between the representing individual and the represented individual. A way to capture this 
is to say that any concrete individual represents at most one abstract individual (see (43)).

Cf. text, p.14

On the present conception, the abstract house design in Figure 2 is an abstract individual and not 
a (first order) property or a kind. This is a somewhat delicate distinction, because properties and 
kinds may be treated as individuals, and yet such a possible treatment should not affect the 
distinction in question.

Dölling (2001) analyzes (first order) properties as (first order) individuals, calling them ‘kinds’.

He relates ordinary individuals to kinds with the help of a relation INST ‘instance of’. For example, he would formalize the statement that \( x \) is a house as ‘\( x \) INST house’, which is 
paraphrasable as ‘\( x \) is an instance of the kind house’. More generally, his kinds play the same role 
that (first order) predicates play in \( L_1 \) (and \( L_x \)). However, Dölling’s strategy of treating properties 
as kinds qua individuals is orthogonal to (and hence compatible with) the present point that the 
abstract house design \( x \) is an abstract individual but not a kind qua individual.

In \( L_x \), the formalization of the statement that \( x \) is a house (namely, an abstract house design) 
would be ‘HOUSE(x)’, where HOUSE is a (first order) predicate of abstract house designs. 
Observe that if we adopted Dölling’s approach here and treated HOUSE as a kind qua individual, 
the formalization of the previous statement would be ‘\( x \) INST house’, which would also bring 
home the point that \( x \) is being treated as a particular individual (albeit abstract) and not as a kind 
qua individual.

Extension of the model structure for \( L_x \) with three pairwise disjoint nonempty sets of templates 
each of which is a subset of \( D \):

\[
\begin{align*}
\text{(39) } & \quad O_m, x, y, z, \ldots \quad \text{(templates for physical objects)} \\
\text{ } & \quad E_m, e, e', e'', \ldots \quad \text{(templates for events)} \\
\text{ } & \quad T_m, t, t', t'', \ldots \quad \text{(templates for times)}
\end{align*}
\]

Defining the set \( M \) to be the union of these three sets of templates, we then introduce variables 
for templates of any sort:

\[
\begin{align*}
(40) \quad & \quad (a) \ M \triangleq O_m \cup E_m \cup T_m \quad (M \text{ is the union of } O_m, E_m, \text{ and } T_m) \\
(41) \quad & \quad (b) \ M, m, m', m'', \ldots \quad \text{(templates)}
\end{align*}
\]

Definition of a notion of derivative existence at a time for templates in terms of the existence at a 
time of physical objects that represent them and of representation (\( \Rightarrow \)) (as a relation on \( O \times M \)):

\[
\begin{align*}
(41) \quad & \quad \text{EXIST}(m, t) \triangleq \exists x [\exists t (x, t) \land x \Rightarrow m] \quad (m \text{ derivatively exists at } t)
\end{align*}
\]

In Figure 2, the house design derivatively exists at a time \( t \) if the house plan exists at \( t \).

The following principle requires every template to derivatively exist at a time:

\[
\begin{align*}
(42) \quad & \quad \text{Axiom. } \forall m [\exists \langle \text{EXIST}(m, t) \rangle] \quad (\text{templates derivatively exist at a time})
\end{align*}
\]

This axiom requires every template to be existentially anchored to a physical object that 
represents it.

Note also that a template ceases to exist at a time (in the sense of \( \text{EXIST} \)) once there is no longer 
any physical object representing it that exists at that time.

The tight fit between a physical object and a template that it represents is captured by the 
following principle, which states that the relation of representation \( \Rightarrow \) is functional with respect 
to its template argument:

\[
\begin{align*}
(43) \quad & \quad \text{Axiom. } \forall x \forall m \forall m' [\langle x \Rightarrow m \land x \Rightarrow m' \rangle \rightarrow m = m'] \\
& \quad \text{(uniqueness of templates in representation)}
\end{align*}
\]

Although every template is instantiated by a physical object, it need not be instantiated by any 
individual. The relation of instantiation \( \triangleright \) is a relation on \( (O \cup E \cup T) \times M \).

If a template is instantiated by a concrete individual, then the concrete individual has to be of the 
appropriate sort:

\[
\begin{align*}
(44) \quad & \quad \forall a \forall m [a \triangleright m \rightarrow (\exists x [m = x] \leftrightarrow \exists t (x, t) \land (\exists e [m = e] \leftrightarrow \exists t (m = t) \land \exists e[a = e] \land (\exists t)[m = t] \leftrightarrow t[a = t])]) \\
& \quad \text{(sortal correspondence for the instantiation of templates)}
\end{align*}
\]

Definition of a relation of derivative instantiation, a relation on \( (O \cup E \cup T) \times M \), in terms of 
instantation and representation:

\[
\begin{align*}
(45) \quad & \quad a \triangleright x \triangleq \exists m [a \triangleright m \land x \Rightarrow m] \quad (a \text{ derivatively instantiates } x)
\end{align*}
\]
Templates may have subtemplates, e.g., the house template in Figure 2 has a subtemplate that leaves out the information about the door and the windows.

Definition of proper subtemplate (\(<\)) in terms of representation and proper part:

\[ m < m' \] =def \[ \forall x \exists y [x \Rightarrow m \land y \Rightarrow m' \land x < y] \] (\(m\) is a proper subtemplate of \(m'\))

Definition of template analogues of the mereological relations in (9), (12), and (13) (where \(Q\) is a one-place predicate of templates):

\[ a \leq m' \] =def \[ \exists x [x \land \exists y [x \land y \Rightarrow m' \land x \leq m']] \] (\(m\) is a subtemplate of \(m'\))

\[ m + m' = def \exists m^+ [m^+ \leq m \land m^+ \leq m'] \] (\(m\) and \(m'\) overlap)

\[ SUM(m, \emptyset) =def \emptyset \] (the sum of \(Q\))

\[ \sigma(m) =def \exists \lambda. \lambda(m' \leq m \land m^+ \leq m'] \] (the sum of \(m\) and \(m'\))

Existence of sums of templates:

\[ Axiom. \exists m[\exists (m)] \Rightarrow \exists m\exists (m, \emptyset) \] (existence of sums for templates)

Three mapping principles regulate the relations of instantiation and representation:

\[ Axiom. \forall a \forall m \forall m' [a \Rightarrow m \land m' \leq m] \Rightarrow \exists b [b \leq a \land b \Rightarrow m'] \] (mapping from templates to instantiations)

\[ Axiom. \forall x \forall y \forall m \forall m'[x \Rightarrow m \land y \Rightarrow m'] \Rightarrow \exists m^+ [m^+ \leq m \land m^+ \leq m'] \] (mapping from representations to templates)

\[ Axiom. \forall x \forall y \forall m \forall m'[x \Rightarrow m \land y \Rightarrow m] \Rightarrow \exists m^+ [m^+ \leq m \land m^+ \leq m] \] (mapping from representations to templates)

A model for \(L_e\) is a pair \(M = (S, I)\), where \(S\) is a model structure and \(I\) is an interpretation function.

\(S\) is now a tuple

\(\langle D, O, E, T, O_m, E_m, T_m, <, \langle \text{trace}, \text{exist}, \text{rep} \rangle, \Rightarrow, \Rightarrow, d_0 \rangle\),

where \(O_m, E_m, T_m\) are nonempty sets of templates for physical objects, templates for events, and templates for times, respectively, such that each is a subset of \(D, \Rightarrow\) is a relation of instantiation (between concrete individuals and templates), \(\Rightarrow\) is a relation of realization (between physical objects and templates), and the other components of \(S\) are as they are in the model structure for \(L_e\).

3.2 The semantic analysis, II

Performance verbs of creation and verbs denoting the creation of abstract individuals take an internal argument designating a template.

Introduction of a thematic relation \(\text{INCREMENTAL}\) between events and templates that is the analogue of the relation incremental between events and physical objects.

Thematic properties corresponding to those in (31a) and (32a) (where \(S\) is a two-place relation between events and templates):

\[ \text{(a)} \] \(\text{UNI-O} (S) = def \forall e \forall m \forall m' [\langle S(e, m) \land S(e, m) \rangle \Rightarrow m = m' \] (\(S\) satisfies uniqueness of templates)

\[ \text{(b)} \] \(\text{UNI-O} (S) = def \forall e \forall e' \forall m [S(e, m) \land e' \leq e] \Rightarrow \exists e'' [e'' \leq e' \land e'' \leq e \land m' \leq m \land S(e'', e''')] \] (\(S\) satisfies uniqueness of templates)

\[ \text{(c)} \] \(\text{UNI-O} (S) = def \forall e \forall m \forall m' [S(e, m) \land m' \leq m] \Rightarrow \exists e'' \exists m'' [m'' \leq m' \land m'' \leq m \land S(e'', e'')] \] (\(S\) satisfies uniqueness of templates)

\(\text{INCREMENTAL}\) satisfies the three properties in (50):

\[ \text{(a)} \] \(\text{UNI-O} (S) = def \forall e \forall e' \forall m [S(e, m) \land e' \leq e] \Rightarrow \exists e'' [e'' \leq e' \land e'' \leq e \land m' \leq m \land S(e'', e'')] \]

\[ \text{(b)} \] \(\text{UNI-O} (S) = def \forall e \forall e' \forall m [S(e, m) \land e' \leq e] \Rightarrow \exists e'' [e'' \leq e' \land e'' \leq e \land m' \leq m \land S(e'', e'')] \)

\[ \text{(c)} \] \(\text{UNI-O} (S) = def \forall e \forall m \forall m' [S(e, m) \land m' \leq m] \Rightarrow \exists e'' \exists m'' [m'' \leq m' \land m'' \leq m \land S(e'', e'')] \)

\(\text{INCREMENTAL}\) should not have a template analogue of uniqueness of events, because it is possible to create a given template more than once.

Definition of a template variant \(\text{CREATED}\) of the thematic relation \(\text{created}\) introduced in (34):

\[ \text{(a)} \] \(\text{CREATED} (e, m) = def \text{INCREMENTAL} (e, m) \land \exists x [\text{created}(e, x) \land x \Rightarrow m] \)

Application of the relation \(\text{CREATED}\) in analysis of the sentence in (3b), headed by \text{design} (compare (36)):

\[ \text{(a)} \] \(\text{design} \Rightarrow \lambda \xi. \xi [\text{design}(e) \land \text{CREATED}(e, x)] \)

\[ \text{(b)} \] \(\text{AGENT} \Rightarrow \lambda \xi. \xi [\text{AGENT}(e, x)] \)

\[ \text{(c)} \] a Victorian style house, \(\Rightarrow \lambda \xi. \xi [\exists x [\text{VICTORIAN-STYLE-HOUSE}(x) \land \text{VICTORIAN-STYLE-HOUSE}(x)]] \)

\[ \text{(d)} \] Sarah \(\Rightarrow \text{Sarah} \)
Syntactic structure sketched in (58a), the resulting event predicate for the sentence is shown in (58b):

(58) (a) [(Sarah) [(AGENT) [(design) (a Victorian style house)]]]
(b) \( \lambda e[\exists e[\text{created}(e, e) \land \text{PERFORMANCE}(e, e) \land \text{POEM-BY-E.E.-CUMMINGS}(e)] \land \text{agent}(e, \text{Sarah})] \)

**Primary analyses:**

- Verbs denoting the **creation of a physical object** (see (1)) are analyzed as relations between events and physical objects with the help of the thematic relation **created** (e.g., (36)).
- Performance verbs of creation (see (2)) are treated as relations between events and templates for events (e.g., (57)) with the aid of the thematic relation **PERFORMANCE**.
- Verbs denoting the creation of a **template** (see (3)) are analyzed as relations between events and templates (e.g., (53) and (55)) with the assistance of the thematic relation **created**.

Data indicate the need for **sort shifters** that are able to shift the internal argument of a verb from one sort to another.

Sentences in (4) and (5) suggest that verbs denoting the creation of a **physical object** sometimes appear to be able to take templates as their internal arguments.

**Sort shifter (SSH-1):**

Applying to a verb denoting a relation between events and physical objects and yields a verb denoting a relation between events and templates such that the templates are instantiated by a physical object:

(59) \( \text{SSH-1} \rightarrow \lambda x[\exists y[R(x, y) \land y \gg x]] \)  

Applying the shifter SSH-1 to **build:**

(60) \( \text{SSH-1(build)} \rightarrow \lambda x[\exists y[\text{build}(e) \land \text{created}(e, y) \land y \gg x]] \)

Assuming a **Victorian style house that Sarah designed** is analyzed as the existential quantifier over house templates in (61a) and that the sentence in (4a) has the schematic syntactic structure in (61b):
4 Comparisons

4.1 Dowty (1979)

Verbs of creation are semantically decomposed with the help of the predicates CAUSE and BECOME, which are used for the analysis of accomplishments:

(68) John painted a picture.

\[ \text{[John paints CAUSE BECOME [a picture exists]]} \]  

(Dowty 1979, (98), p. 91)

The intuitive meaning assigned to this representation is that John’s painting activity causes a picture to come into existence.

von Stechow (2001, sect. 4): the major flaw in Dowty’s analysis in (68) is that the corresponding truth conditions prohibit any picture at all from existing at the beginning of the interval of painting, and yet this is clearly too strong, because there may well be (other) pictures that exist in the world at the beginning of this interval.

Dowty’s treatment does not handle performance verbs of creation (see (2)) or those denoting the creation of an abstract individual (see (3))—at best it serves for verbs denoting the creation of a physical object.

(69) (a) perform \[ \lambda \mathcal{E}(\text{PERFORMANCE}(e, e)) \]
(b) a sonata \[ \lambda \mathcal{E}(\exists \mathcal{E}(\text{PERFORMANCE}(e, e) \land \text{SONATA}(e))) \]
(c) perform a sonata \[ \lambda \mathcal{E}(\exists \mathcal{E}(\text{PERFORMANCE}(e, e) \land \text{SONATA}(e))) \]

4.2 Krifka (1989, 1992)

Krifka does not offer a treatment of verbs of creation.

His notion of graduality (Krifka 1992, p. 42), which characterizes thematic relations that satisfy the properties uniqueness of objects, mapping to objects, and mapping to events in his framework, does not distinguish between ‘effected patients’ and ‘consumed patients’.

His properties of mapping to objects and mapping to events are stronger than the properties of weak mapping to physical objects and weak mapping to events that I define in (32).

The property of weak mapping to events in (32b) allows for this, as I pointed out in section 2.2.

His mapping to objects is also too strong, because it would require every subevent of the building event to be an event in which a part of the house is built.

Krifka (1992, p. 46) notes in passing a possible extension of his approach for performance verbs of creation such as play in play a sonata (see also Krifka 1989, pp. 198–199). He suggests introducing a domain of types and a relation of realization between tokens and types so that play could describe the realization of a type.
4.3 Von Stechow (2001)

The idea is that the analysis of verbs of creation makes use of a thematic relation I-Theme for the internal argument:

$$I-\text{Theme} \equiv \lambda w, e [\text{BECOMING}(w, e)]$$

(70) I-Theme $$= \lambda w, e \exists \lambda \forall x [\text{BECOMING}(w, e)]$$

(von Stechow 2001, p. 310)

In light of von Stechow’s definition of BECOMING (p. 290), this says that $$x$$ is an I-Theme in $$w$$ just in case $$x$$ does not exist in $$w$$ at the beginning of $$e$$, $$x$$ exists in $$w$$ at the end of $$e$$, and $$x$$ is undefined for existence in $$w$$ at any time properly between the beginning and end of $$e$$.

No understanding of the motivation for saying that $$x$$ is undefined for existence between the beginning and the end of $$e$$.

Von Stechow’s treatment covers only verbs denoting the creation of a physical object—he does not mention performance verbs of creation or verbs denoting the creation of an abstract individual.

4.4 McCready (2003a,b)

McCready focuses on the interaction between progressivized verbs of creation and anaphoric reference to partially created objects. He aims to account for contrasts such as the following:

(71) (a) John was painting a picture. #It was a masterpiece. (McCready 2003b, (2a), 328)
(b) John was building a house. His brother designed it. (McCready 2003b, (4a), 328)

McCready’s idea is that $$it$$ in (71a) cannot refer back to the partially completed picture that John was painting because the noun masterpiece may only apply to completed objects. In contrast, $$it$$ in (71b) refers to an abstract object (namely, a house design) and not to the partially completed house that John was building.

McCready basically employs von Stechow’s I-Theme, but he takes its definition to be what is in von Stechow’s fn. 17 (see my fn. 19), silently correcting the typos and discreetly discarding what appears in (70):

$$I-\text{Theme}(e, x) = \exists \forall e' \in e' \subseteq e \supseteq (f(e') \subseteq x) \land \exists \text{BEG}(e'), f(e')) \land \exists \text{END}(e'), f(e'))$$

(McCready 2003b, (9), p. 330)

In order to treat build in (71b), he takes verbs of creation “to be ambiguous between a reading in which the verb acts as a ‘verb of realization,’ which selects for a property complement, and a reading taking an actual object, which describes an actual creation event.”

The reading of build in (71b) is the one on which it takes a property complement. McCready represents the nonprogressivized version of the first sentence in (71b) as the following event predicate, which serves as the input to the progressive operator:

(73) John build-a house: Ie[build(john, $$\lambda x \{\text{house}(x)\})$$]

He takes the abstract objects of verbs of creation to be properties (extensionally, sets) and not bona fide first order individuals, albeit abstract.

Yet consider (e.g.) Sarah designed a house: it would be incorrect to say that Sarah designed the property of being a house—certainly she did not manage to do that. To get around this, McCready could say that she designed a subproperty of the property of being a house, which would extensionally amount to a subset of the set of houses. But if no one ever built the house that she designed, then she would have effectively designed the empty set, which is a very counterintuitive result.

He could then try to get around this by intensionalizing the property complement that design takes (e.g., by construing it as a function from possible worlds to sets of individuals), but this move would lack independent support in that design otherwise behaves like an extensinal verb (unlike seek, for example).

But even putting this problem aside, McCready still has to clarify more explicitly the connection between (e.g.) build as a verb that takes a property complement (see (73)) and build as a verb that takes an individual argument, because from the formula in (73) it does not follow that a physical house is built (and the addition of a simple tense operator will not guarantee this either).

The present approach does not face these difficulties: Templates are first order individuals, albeit abstract, and behave as individuals for the purposes of quantification, anaphoric reference, and the like. Finally, the two senses of build that McCready is concerned with are analyzed in (36a) and (60), being explicitly related with the help of the sort shifter SSH-1 in (59).

4.5 Conclusion

Verbs of creation come in three sorts: verbs that denote the creation of a physical object (e.g., build), performance verbs of creation (e.g., sing), and those that denote the creation of an abstract individual (e.g., design).

The analysis presupposes a model structure that has an existence predicate and distinguishes between physical objects, events, times, and three kinds of templates (templates for physical objects, templates for events, and templates for times).

Templates are abstract (first order) individuals that are existentially anchored to physical objects with the help of a relation of representation and which may also be connected to concrete individuals by means of a relation of instantiation.

The analysis provides a set of sort shifters that serve to capture systematic ambiguity among verbs of creation (e.g., the distinction between build as a verb denoting the creation of a physical object and build as a verb denoting the instantiation of a template).

The approach fares better than the competition as a general account of verbs of creation.