EGG intro semantics week 2

Force dynamics and event structure

Rob Truswell

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Yesterday

- A lattice-theoretic approach to event structure, in parallel to Link's approach to D_e.
- Prospects for addressing key event-structural puzzles within that approach.
- A residual worry that we're now overexplaining things. E.g. CAUSE and BECOME can tell us something about aspect, but so can our lattice structure.

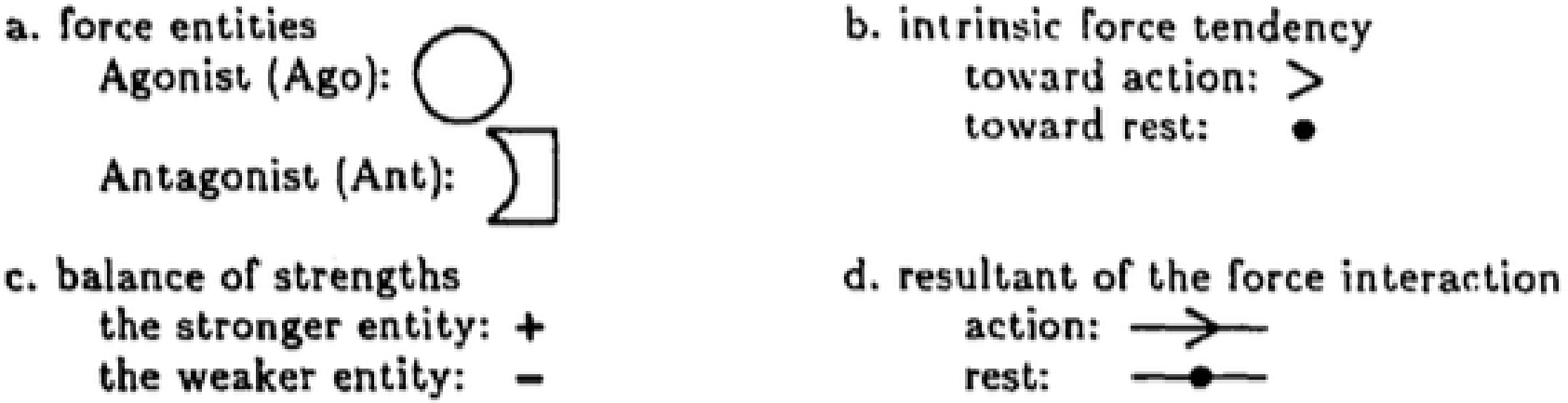
Today

- Recent attempts to incorporate force dynamics within formal semantic models.
- Consequences for classical decompositional approaches to event structure.
- Our guides, for the most part: Bridget Copley and Heidi Harley (their 2015 L&P paper).

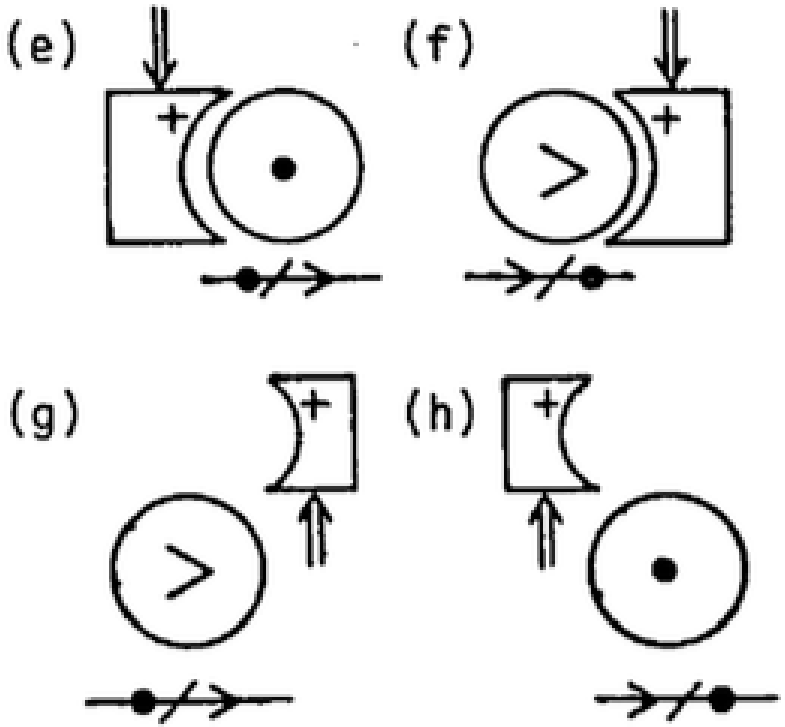
Non-culminating accomplishments: Two unsatisfactory approaches

1. Assume causal relation between process and culmination (Dowty)
   - Requires extra machinery with inertia worlds.
2. Assume an algebra of events, with non-culminating accomplishments denoting $e' \sqsubset_p e \wedge P(e)$ (Bach hints at this, Terry Parsons developed it).
   - Problem is, what does it mean to say that $e' \sqsubset_p e \wedge P(e)$, when your logical form only entails the existence of e'?

Classical force dynamics (Leonard Talmy)



Classical force dynamics



Ago's tendency	(e,h): toward rest (f,g): toward action
Ant's effect	(e,f): causing (g,h): letting
Ago's resultant	(e,g): starting (f,h): stopping

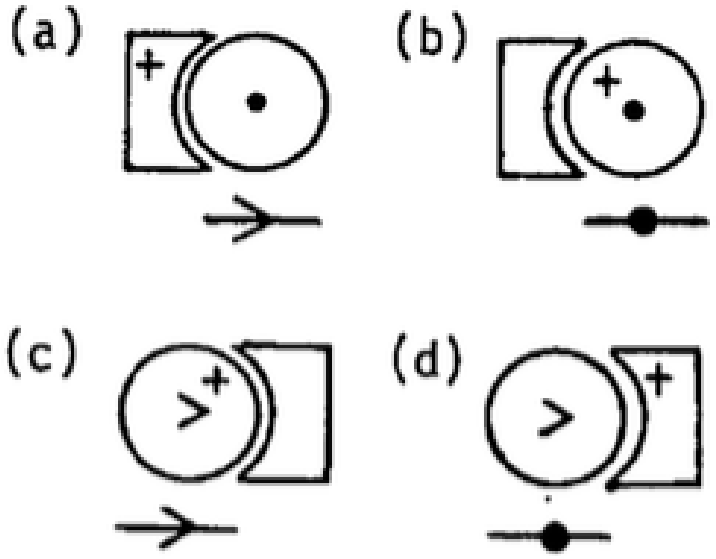
(e) The ball's hitting it made the lamp topple from the table.

(f) The water's dripping on it made the fire die down.

(g) The plug's coming loose let the water flow from the tank.

(h) The stirring rod's breaking let the particles settle.

Classical force dynamics



Ago's tendency (a,b): toward rest
(c,d): toward action

Ago's resultant (a,c): action
(b,d): rest

Ago's force relative to Ant's
(a,d): lesser
(b,c): greater

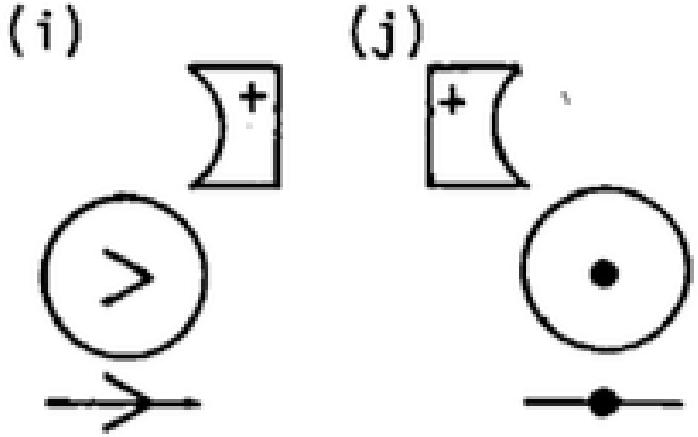
(a) The ball kept rolling because of the wind blowing on it.

(b) The shed kept standing despite the gale wind blowing against it.

(c) The ball kept rolling despite the stiff grass.

(d) The log kept lying on the incline because of the ridge there.

Classical force dynamics



(i) The plug's staying loose let the water drain from the tank.
(j) The fan's being broken let the smoke hang still in the chamber.

Summary

- Although Talmy's diagrams and examples can be somewhat mad, there's an important point.
- Verbs like *keep* and *let* can describe dynamic events in which nothing happens.

(1) a. The rock is keeping the door open.
b. Friction is preventing the log from rolling down the hill.
c. The lack of a draught is letting the smoke linger in the room.

- This suggests that CAUSE and BECOME are at best special cases of a broader system.

Formalizing forces I: Situations

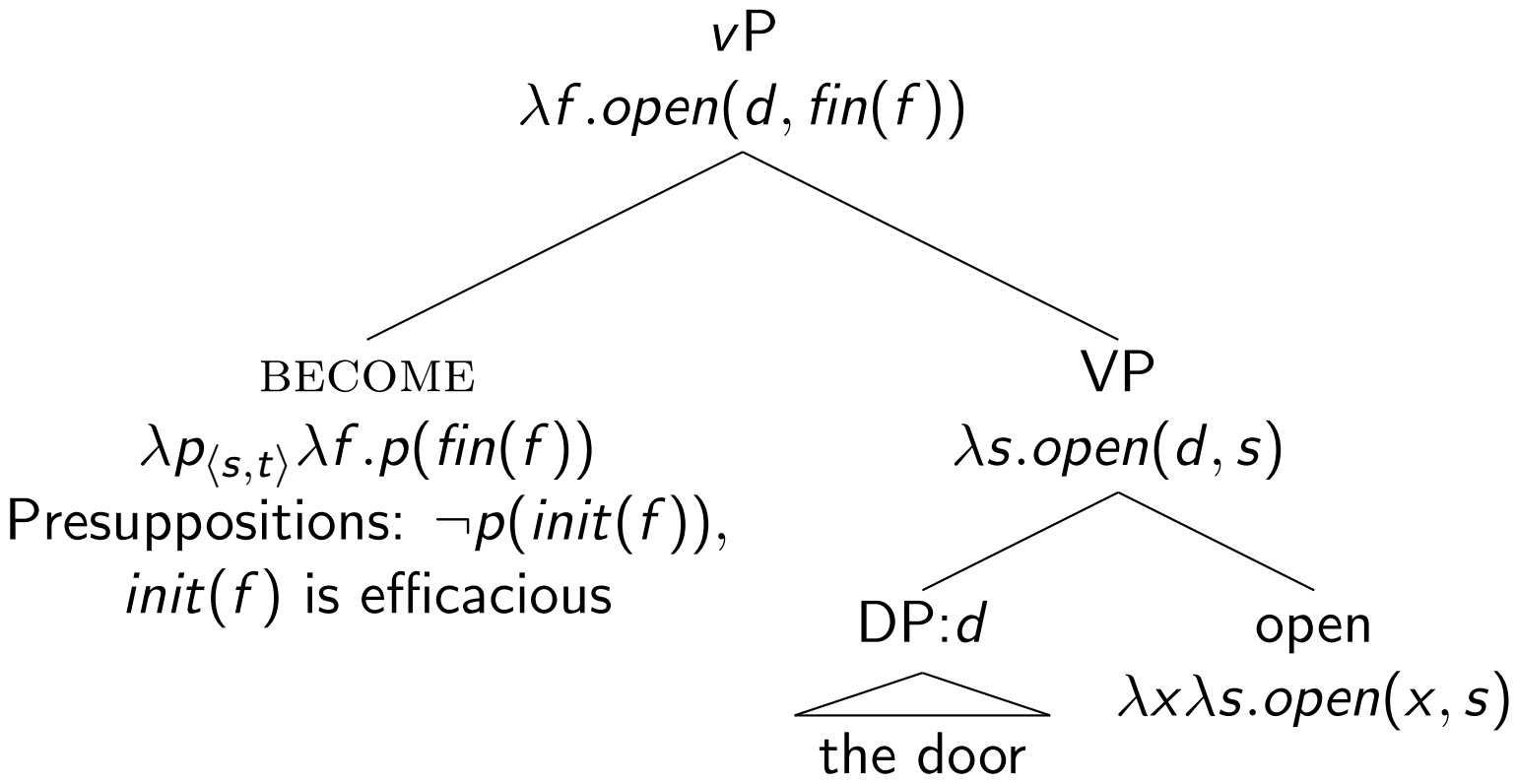
- Talmy's force-dynamic diagrams contain a (finite) set of individuals and "tendencies" associated with each one.
- Call such a structure a *situation*: a set of individuals with properties attributed to them.
- The tendencies can then be "summed" (like a free-body diagram) to produce a "global" tendency for that situation.
- We can then model the forces in a situation s as a function from s to s'.
- (Slightly unintuitive as forces now modify situations as a whole: we have lost the intuition that forces are exerted by x on y).
- Causal chains are then easily captured: if f_n is the force associated with s_n, then $s_{n+1} = f_n(s_n)$, and $s_{n+2} = f_{n+1}(f_n(s_n))$, etc.

Ceteris non paribus cases

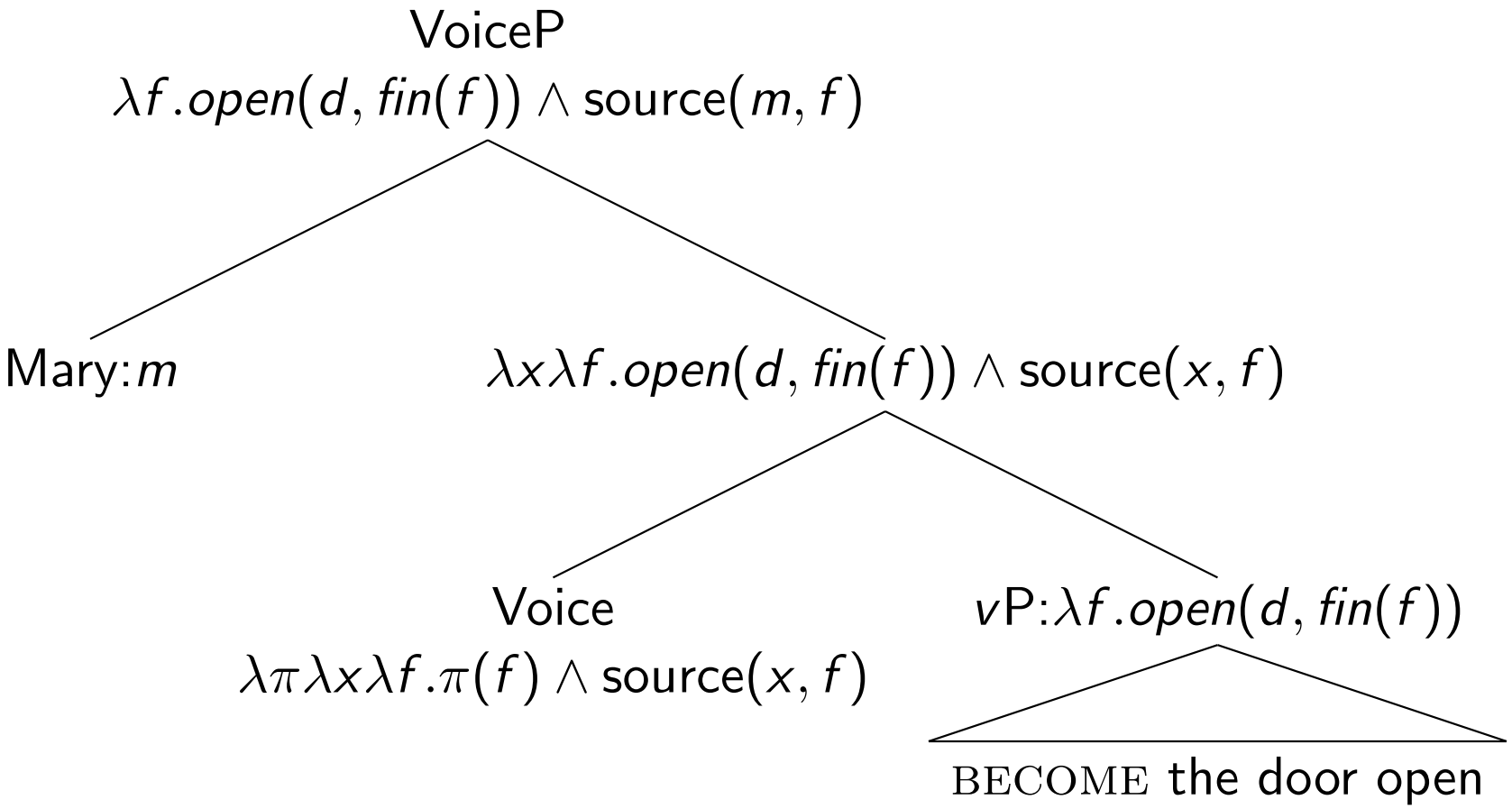
- Situations can be ordered by inclusion: a bigger situation contains more individuals and/or "tendencies" than a smaller one.
- Assume that $s_1' > s_1$. Then there's no guarantee that $f_1' = f_1$.
- That's the root explanation of non-culmination.
  - John was painting a picture. s_1, John, tendency to paint a picture.
  - But he got distracted. s_1', John$^-$, tendency to paint a picture, distraction$^+$
- Aspects which entail culmination (*John painted a picture*) induce a presupposition that s_1 is *efficacious* ($f_1(s_1)$ is realized).

Compositional implementation: Inchoatives

- Copley & Harley provide a compositional syntax and semantics where force variables play the role traditionally delegated to Davidsonian event variables.



Compositional implementation: Causatives



Summary and extensions

- A force-based ontology offers two possible advantages over standard event-based approaches:
  1. Causation is only one of a family of dynamic congigurations of forces
  2. Formalizing forces as functions from situations (sets of individuals and properties) to situations allows a nonmodal treatment of nonculmination.
- Different event types reduce to different denotations of v
  - $[\![\mathrm{v}_{APPEAR}]\!] = \lambda x \lambda f . x < fin(f)$
    presupposed: $\neg(x \leq init(f))$
- Davidson's two arguments for events are dissociated: no obvious way in which Davidon's *it* can be construed as anaphoric to a force.

Sources of forces

- Copley & Harley identify external arguments as sources of forces.
- Not clear why a force (which is a property of a situation) should be primarily associated with a single individual in a situation.
- Also not clear that source is a single (non-disjunctive) notion.
  - Agent
  - Causer
  - (Obstacle, Accomplice, . . .)?
- Possibility for the future: sources correspond to ways of delimiting events.

Ways of individuating events

1. Physical events:

   (2) a. The river flowed
   b. The ballon burst
   c. The falling tree crushed the car

2. Intentional events:

   (3) a. John is working out
   b. John spat
   c. John is building a snowman

Causation vs. intention

- Initiation of physical event determined in some way by causation; initiation of intentional event determined by manifestation of intention.

  (4) #Hey look, the ball is rolling down the hill!
  (Context: Ball is stationary on top of a hill but strong wind makes it apparent that it will soon be blown down the hill)

  (5) Hey look, the round man is rolling down the hill!
  (Context: Man is limbering up on top of a hill, wearing a special suit designed to protect people rolling down hills)

  (6) #Hey look, the round man is breaking his ribs!

- Languages (Malagasy?) where nonculmination entails intention.

Further possibilities

3. Strategic events: delimited by the intention of a non-participant individual. E.g. plays (not written or directed by actors), wars (not started or ended by soldiers).

   (7) a. The ship sinks to further the plot
   b. I sold my house

4. Analytical events: events without clear sources. Often recognized *post hoc*: an average person present at the time still couldn't have seen the last ice age. Note the difficulty of mapping onto verbal argument structure.

   (8) a. The last age.
   b. World War II

What would this mean?

- Situations may formally be just configurations of individuals and properties.
- But the situations that we have names for involve either:
  - Configurations of small numbers of individuals, one of which has special status as a Talmy-esque antagonist; or
  - Typically large-scale population-level changes, often recognized *post hoc*.
- Identifying a source, and the force that corresponds to it in a given situation, is a key part of delimiting dynamic events.

General summary

We have seen:

- Arguments for a domain of individuals structured as a lattice, with a lattice of masses as a proper subpart.
- Arguments for many sentences as descriptions of events.
- Arguments for several parallels between the structures of the domains of events and individuals.
- Mappings between objects and events embedded within an algebraic theory of aspectual classes.
- Arguments for a force-theoretic analysis of a larger set of dynamic event types.

Major open questions

- How do forces relate to events? Can the full Bach/Krifka machinery be recast in terms of forces and situations?
- How are events delimited, and what is the basis of the notion of *source*?
- The rest of the ontology: degrees, worlds, ...