

# A process semantics for non-selected subject resultatives in English

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- We develop a compositional analysis of an understudied class of *non-selected subject resultatives*.
  - These examples are composed of a *result verb* in Rappaport Hovav & Levin's (2010) sense and a PP expressing path of motion.
  - Of note is the fact that the subjects of such resultatives need not undergo the change of state encoded in the verb.
- (1) My Chinese delivery is so hot it **melted** through the plastic container. (Web)
- Such constructions pose a challenge for proposed constraints on event structure, such as MANNER/RESULT COMPLEMENTARITY and the ARGUMENT-PER-SUBEVENT CONDITION (Rappaport Hovav & Levin 2001).
  - Examples of this sort have only been discussed in very recent work (Ausensi & Bigolin 2023; Yu et al. 2023), but these works have not fully characterized their semantic behaviour.
  - We show that an analysis based on Williams' (2015) *process semantics* for resultatives accounts for all of the properties of these resultatives, including:
    1. The fact that the subject need not undergo the change of state encoded in the verb.
    2. The fact that the subject is interpreted as the *effector* of the process expressed by the resultative.
    3. The fact that the subjects of such resultatives *may* undergo the change encoded in the verb in certain contexts, due to underspecification of the relationship between the subject and the means event encoded in the verb.

## Roadmap:

1. Non-selected subject resultatives
2. The subject as effector
3. A process semantics for non-selected subject resultatives
4. "Selected subject" readings
5. Conclusion

# 1 Non-selected subject resultatives

- The class of resultatives we concern ourselves with consist of an intransitive change of state verb accompanied by a PP expressing the subject's path of motion in the event.
- (2) provides naturally occurring examples of such resultatives, which occur frequently in corpora and on the web.
  - a. My Chinese delivery is so hot it **melted** through the plastic container. (Web)
  - b. In the scorching heat, having her back to the train, the metal **burned** into her skin, giving her blisters and boils. (Web)
  - c. The bullets **ripped** into the tissue of his back and shoulder. (GloWbE)
  - d. Any moment a bullet can come **shattering** through the glass and hit any one of us. (GloWbE)
  - e. The river **eroded** into the flood deposits, exposing the cross stratification in these impressive dunes. (Web)
- The existence of this class of resultatives is notable for several reasons.
- The first has to do with MANNER/RESULT COMPLEMENTARITY (Rappaport Hovav & Levin 2010).
  - (3) Manner/Result Complementary: Manner and result meaning components are in complementary distribution: a verb lexicalizes only one.
    - A number of explanations for this effect have been proposed, including the idea that manner and result roots are associated with different positions in an *event structure template* (Rappaport Hovav & Levin 2010), or a syntactic variation of this idea (Mateu & Acedo-Matellán 2012).
    - However, as Yu et al. (2023) point out, the class of examples in (2) challenges such explanations.
      - This is because the verbs involved are all *result verbs*, entailing change of state, but with no particular manner entailments.
      - Since on these approaches the root occupies the result state position of an event structure template (or, on a syntactic approach, the complement of *v*), no result phrases are expected to be possible, contrary to what we observe in the examples above.
    - Second, these cases violate another constraint, Rappaport Hovav & Levin's (2001) ARGUMENT-PER-SUBEVENT CONDITION.
  - (4) Argument-Per-Subevent Condition: There must be at least one argument XP in the syntax per subevent in the event structure.
- Of note in these examples: the subject does *not* undergo the change encoded in the verb.
  - For example, the resultative component of (2a) is true in a context in which the plastic container melts, and the Chinese delivery, still intact, moves through the container. This can be shown with the explicit context below.
- (5) CONTEXT: I ordered Chinese food to celebrate my successful dissertation defense. The food was placed in a plastic container, but it was so hot that the plastic melted, and the food spilled out of the container. So **my Chinese delivery melted through the plastic container**.

- (5) CONTEXT: John finds a piece of metal on the ground. It turns out the metal is very hot, but is not itself burning. John foolishly picks up the metal, which starts to burn his skin and sink into his hand. So **the metal burned into John's hand**.
- As no XP is present in these examples that overtly expresses the theme of the result verb, the ARGUMENT-PER-SUBEVENT CONDITION is violated.
  - The subjects are *non-selected* as they do not correspond to an argument of the main predicate.
  - Of course, in many of these examples the unstated theme is understood to be the same as the goal of motion expressed by the complement of the preposition.
  - This phrase, however, is not an argument of the verb, and it can be shown that the identification of the goal of motion with the theme is inferred rather than entailed.
    - In particular, there are cases where the goal of motion does not undergo the change encoded by the verb.
    - For example, in (6), the vault itself does not burn; rather, the thieves burned something (say, the door to the vault) in order to enter it.
- (6) The largest bank robbery took place in England in 1967 when thieves **burned into the vault** of the London Cooperative Society (Web)

## 2 The subject as effector

- If the subject is not the theme of the verb, then what is it?
  - Yu et al. (2023) suggest in a footnote that the subject is an underlying argument of the motion PP, which raises to subject position.
    - Ausensi & Bigolin (2023) explicitly propose this.
  - While they provide no semantics specifically for this class of examples, we can ascertain what the analysis of (2a) would be using the semantics they provide for other phenomena they consider to be of the same sort, yielding in (7).
- (7)  $\exists x \exists e [\exists s [\text{BECOME}(e, s) \wedge \text{BURNT}(x)(s)] \wedge \exists s' [\text{CAUSE}(e, s') \wedge \text{IN}(\textit{the metal})(\textit{her skin})(s')]]$
- In words, this says that there is an event in which something becomes burnt, and this event causes the metal to be in her skin.
  - This leaves open how exactly the burning event is brought about, and herein lies a problem: non-selected subject resultatives place constraints on what can be the intuitive *cause* of the event.
  - If another individual causes the change of state, non-selected subject resultatives are infelicitous ((8)).
  - Note that sentences with unaccusatives are acceptable in such contexts, and thus the infelicity of the sentences cannot be attributed to the use of an unaccusative verb.

- (8) a. CONTEXT: A blowtorch went off next to a plastic container, causing **it to melt** and the food inside to spill **through it**.  
 #The food **melted through the plastic container**.  
 (cf. The plastic container melted.)
- b. CONTEXT: A fire surrounded a box, **burning the floor** around it and causing the box to fall **through the floor** to the floor below.  
 #The box **burned through the floor**.  
 (cf. The floor burned.)
- These contexts satisfy the predicted truth conditions of non-selected subject resultatives on Yu et al.'s approach.
  - A change of state (the melting and burning events in (8) directly causes the surface subject to undergo motion.
  - And yet the sentences above are infelicitous in the provided contexts. This tells us that something is missing in Yu et al.'s account.
  - We propose that this is because the unselected subject in these cases is interpreted as the *effector* of the event in question.
    - In other words, the subject acts as the catalyst of the change of state.
  - For example, in (2a), the heat from the Chinese delivery itself causes the plastic to melt, thereby allowing it to pass through the container.
    - Likewise, in (2b), the metal is hot, which allows it to cause the skin to burn and thereby move into the skin.
  - The examples in (8), on the other hand, are infelicitous because the event is not caused by a property of the subject, but by a phenomenon independent of the subject.

### 3 A process semantics for non-selected subject resultatives

- To cash out the intuitions above, we adopt a *process semantics* for non-selected subject resultatives (Williams 2015; McNally & Spalek 2022).
- On this approach, a resultative is a predicate of a *process* event, distinct from the event intuitively contributed by the verb and the one contributed by the result phrase.
  - Instead, the verb contributes a *means event*, by which the process is carried out, and the result XP contributes the *result* eventuality, in which the process culminates.
  - A process semantics is thus *trivalent*, in contrast to the common result patient analysis due to Kratzer (2005), which recognizes only a causing event (identified with the means event) and a result state.
- Building on the proposals in Williams and McNally & Spalek, the verbal predicate and the result predicate compose by a rule called KOMP(OSITION), defined in (9).

- KOMP existentially closes the event arguments of the verb and the result predicate, and returns a predicate of the process event, relating the arguments of the verb and result phrase to the process event via the MEANS and END relations, respectively.

(9)  $KOMP(V)(V') = \lambda e. \exists e', e'' [MEANS(e, e') \wedge END(e, e'') \wedge V(e') \wedge V(e'')]$

- For the sake of explicitness, we adopt the following analyses of the components of the resultative.
- First, we treat result verbs as event predicates.
  - This departs from Beavers & Koontz Garboden's (2020) analysis of change of state roots as predicates of states that entail change, but is in line with Yu et al.'s analysis of the same root class as predicates of events with a result state entailment.

(10)  $melt \rightsquigarrow \lambda e. MELT(e)$

- Second, the prepositional phrase is also modeled as a predicate of eventualities expressing the relation between two objects.
- We assume that the prepositional phrase has a PRO subject bound by the surface subject, and is interpreted as an individual.
  - Other analyses, such as one involving explicit binding in the semantics or a modification to KOMP, are possible as well.

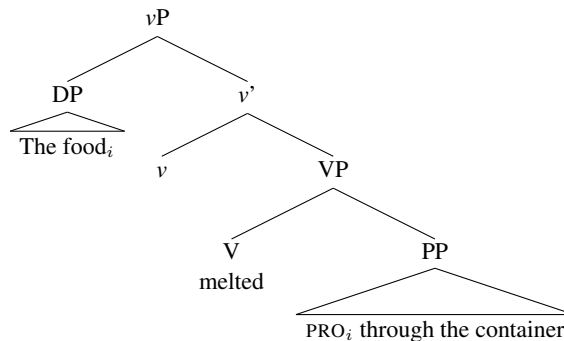
(11)  $PRO \text{ through the container} \rightsquigarrow \lambda e. THROUGH(the. food, the. container)(e)$

- Finally, the effector argument is introduced outside of the resultative, and is related to the process event, following Williams' (2015) treatment of thematic roles more generally.
- For the role EFFECTOR, we follow Van Valin & Wilkins (1996) and Koontz-Garboden (2009) in treating it as an underspecified thematic role with fewer proto-agent entailments, in the sense of Dowty (1991), than AGENT.
- We will have a *v* head introduce the EFFECTOR argument.

(12)  $v \rightsquigarrow \lambda x. \lambda e. EFFECTOR(e) = x$

- Putting these ingredients together, we arrive at a syntactic analysis of non-selected subject resultatives as in (13), with the semantic analysis as in (14).

(13)



(14)  $\lambda e. \text{EFFECTOR}(e) = \text{the food} \wedge \exists e', e'' [\text{MEANS}(e, e') \wedge \text{END}(e, e'') \wedge \text{MELT}(e') \wedge \text{THROUGH}(\text{the food})(\text{the container})(e'')]$

- This analysis has several consequences that reflect the properties of non-selected subject resultatives discussed above.
- First, the subject is not an argument of the means event (the melting in (2a), represented in (13)).
  - In fact, the means event has no syntactically or semantically represented arguments at all. This is why no argument needs to be projected, and captures the non-selected property of the subject in these resultatives.
- Second, the subject is the effector of the process, in this case of moving through the container by means of a melting.
  - This accounts for its behavior in (8): in those contexts, the subject cannot be interpreted as setting in motion the process in which it participates.

## 4 Selected subject interpretations

- While we have discussed the resultatives in (2) in the context of their non-selected subject reading, there are string-identical resultatives that are compatible with contexts in which the subject *does* undergo the change of state encoded in the verb.
- (15)
- a. The ice **melted** through the cracks.
  - b. A splinter **split** off of the piece of wood.
  - c. The tiny shockproof glass window **shattered** into the passenger compartment. (Web)
- These examples are fully compatible with the ARGUMENT-PER-SUBEVENT CONDITION, as the subject does undergo the change encoded in the verb.
  - Nevertheless, there is a question of how they relate to non-selected subject resultatives, given the fact that they are otherwise identical to them.
  - We propose that these are in fact instances of the same kind of resultative, and that the apparent difference in interpretation between the cases in (15) and those in (2) falls out from an *underspecification* of the relationship between the effector and the means event.
  - Recall our semantics in (14) for example (2a), and note that no relationship between the effector argument ('the food') and the means event ( $e'$ ) is established.
  - This does not imply that there is no relationship between the two.
    - Rather, the semantics of the resultative is *compatible* with processes whose effectors are arguments of the means, but also with those whose effectors are not.
  - We thus represent the meaning of (15a) as in (16) below.
- (16)  $\lambda e. \text{EFFECTOR}(e) = \text{the ice} \wedge \exists e', e'' [\text{MEANS}(e, e') \wedge \text{END}(e, e'') \wedge \text{MELT}(e') \wedge \text{THROUGH}(\text{the ice})(\text{the cracks})(e'')]$

- Because the relationship between the effector and the means event is underspecified, the ice may be understood as the theme of the melting event.
  - As a consequence, the ice is the effector of its own melting event, much as in Koontz-Garboden’s (2009) analysis of anticausatives more generally.
  - The availability of a non-selected vs. a “selected” reading of this class of resultatives seems to be regulated by issues of world knowledge.
    - For example, ice is more likely to be permitted to move into cracks by melting than by causing something else to melt.
    - By the same token, hot food is more likely to pass through a container by melting the container than by means of an event in which the food melts.
  - Given this, our approach predicts that otherwise implausible readings of these resultatives can be facilitated by the right contexts, essentially reversing the pattern of interpretations. This prediction is correct, as the following examples show.
- (17) a. CONTEXT: A server at a restaurant put some leftover food in a container. However, they accidentally placed the container under a hot light, causing the food to melt and pass through a hole in the side of the container.  
**The food melted through (the cracks in) the container.**
- b. CONTEXT: A scientist placed some ice chilled to  $-100^{\circ}$  in a special container. However, they accidentally placed the ice in a strange container made from a substance that melts when it comes into contact with water molecules. Because of this...  
**The ice melted through the container.**

## 5 Conclusion

- We have developed an analysis of non-selected subject resultatives built on a process semantics along the lines of Williams (2015) and McNally & Spalek (2022).
  - This analysis allowed us to capture the fact that the subject of these resultatives needs not be an argument of the means event, but must be an effector of the process.
  - Given its underspecification of the relationship between the effector and the means event, it also permits an analysis of cases in which the subject *is* interpreted as an argument of the means predicate.
  - Several areas for future research remain.
  - First of all, while the analysis in Yu et al. (2023) does not adequately capture the properties of non-selected subject resultatives, the analysis we have developed here seems to be extendable to all of these cases they considered, modulo their transitivity.
    - For instance, their example in (18) has similar properties to the examples we have considered in this talk; the object in (18a) and subject in (18b) do not undergo a breaking, and (18b) has an effector interpretation.
- (18) a. The monks broke the corpse loose from the deck.

b. The corpse broke loose from the deck.

- Our analysis thus may subsume the analysis of the resultatives in Yu et al. We will investigate this in more detail in future work.
- Another question: while English permits non-selected subject resultatives with verbs formed from change of state roots, it does not generally permit resultatives constructed from verbs of other classes.
- However, other languages, such as Mandarin, permit a much larger class of verbs to appear in non-selected subject resultatives.
- For example, the subject of the Mandarin resultative in the following example is not an argument of the means verb *ku* ‘cry,’ but instead is the effector of a process that results in Lisi’s eyes becoming red by means of a crying event (Williams 2007; 2015).

(19) zhe jian shi ku hong le Lisi de yanjing  
this CL matter cry red PRF Lisi GEN eye  
‘This matter made Lisi’s eyes red from crying.’ (lit. This matter cried Lisi’s eyes red)

- There is thus cross-linguistic variation in the range of non-selected subject resultatives permitted in a language, which we hope to focus on in future research.

Thank you!

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## Appendix

### Attested examples

- (20) **Rip**
- A bear **ripped** into the tent of three sleeping women in a Glacier National Park campground Thursday, dragged one of the women away and killed her. (Web)
  - The bullets **ripped** into the tissue of his back and shoulder. (GloWbE)
- (21) **Melt**
- My Chinese delivery is so hot it **melted** through the plastic container. (Web)
  - Molten nuclear fuel can **melt** through the reactor's safety barriers. (GloWbE)
- (22) **Burn**
- In the scorching heat, having her back to the train, the metal **burned** into her skin giving her blisters and boils. (Web)
  - I once again felt the nails violating my flesh, the rope **burning** into my wrists. (GloWbE)
- (23) **Shatter**
- Any moment a bullet can come **shattering** through the glass and hit any one of us. (GloWbE)
- (24) **Break**
- He's pulled them from Brainerd-area lakes after their owners **broke** through the ice. (GloWbE)
- (25) **Tear**
- The knife's blade **tore** into her back, was yanked out, and stabbed her again. (COCA)
  - Tornadoes **tore** through the Dallas-Fort Worth metropolitan area in Texas on Tuesday. (COCA)
- (26) **Split**
- The crack of glass on wood **split** through her head like an axe. (COCA)