Change-of-State in the Roots of Verbs: A Typological Study

John Beavers
jtbeavers@utexas.edu
The University of Texas at Austin

(Joint work with Michael Everdell*, Kyle Jerro*, Henri Kauhanen[†], Andrew Koontz- Garboden[†],
Elise LeBovidge*, and Stephen Nichols[†]
* = The University of Texas at Austin, † = The University of Manchester)

1   Introduction

- One of the most basic questions about verb meanings is what their basic building blocks are, and how those building blocks are composed into more complex meanings.

- Howadays it is typically assumed that verb meanings consist of an "event structure" constraining the events described by the verb, consisting of (a) a template built from basic event-denoting predicates (e.g. via functional v heads; Marantz 1997) and (b) idiosyncratic roots filling in real world meanings (e.g. manner, state; Rappaport Hovav and Levin 1998):

    (1)   a.   John flattened the rug $\approx$ [$_{v\text{P}}$ John [$_{v'}$ v_{cause} [$_{v\text{P}}$ the rug [-$en_{v_{\text{become}}}$ $\sqrt{flat}$]]]]

           b.   Kim cracked a vase $\approx$ [$_{v\text{P}}$ Kim [$_{v'}$ v_{cause} [$_{v\text{P}}$ a vase [$_{v'}$ v_{become} $\sqrt{cracked}$]]]]

- The template defines the verb's lexical aspectual properties, argument structure, and regular derivational morphology; the root just determines the verb's idiosyncratic morphology.

- An underexplored question (though see Dowty 1979, Goldberg 1995, Wechsler 2005, a.o., for related discussion) is whether there is a clean divide between meanings entailed by roots and by templates, e.g. are CAUSE and BECOME *only* introduced templatically?

- The null hypothesis is that if templates determine grammatical behavior semantically, such meanings should be excluded from roots, Embick's (2009) "Bifurcation Thesis for Roots" (BTR) and Arad's (2005) "Root Hypothesis" (also Borer 2005, Dunbar and Wellwood 2016).

- If this is true, then all change-of-state verbs should have the same templatic structures (e.g. that introduce an entailment of change) and when the roots of change-of-state verbs are used in templates lacking entailments of change no such reading should arise.

- We present a broad typological study into this question, focusing on the change entailment in change of state verbs, a meaning that on all approaches is templatic. We show that across languages certain root classes entail change regardless of the template, and show morphosyntactic properties indicating that they are derived in distinct ways not predicted by the BTR.

- We argue that some roots entail templatic meaning, which furthermore has grammatical effects, ultimately arguing against the BTR (Beavers and Koontz-Garboden in prep).

- Caveat: Since much work on root meaning lately has come from work in syntactified event structures, I adopt that formal framework here. Nothing hinges on this; the same questions and answers can be replicated if event structures are lexical semantic representations related to phrase structures by correspondence rules (Levin and Rappaport Hovav 1995).

2 Change-of-State Roots

- Few accounts are explicit as to the meaning of roots of change-of-state verbs, but the BTR entails that it is purely stative, with no templatic meaning packaged into it, such as change.

- While this may be correct for roots, it is not for others (cf. Megerdoomian 2002, Koontz-Garboden 2006). We distinguish Dixon's (1982) **property concept (PC) roots** (those of Levin's 1993: 245 deadjectival change-of-state verbs) from **result roots** (those of Levin's various non-deadjectival change-of-state verbs). The roots for our study are:

(2) **Property Concept**
  - a. *Dimension*: large/big/enlarge, small/shrink/shrunken, short/shorten, long/lengthen, deep/deepen, wide/widen, tall/height/heighten
  - b. *Age*: old/aged/age
  - c. *Value*: bad/worsen/worse, good/improve/improved
  - d. *Color*: white/whiten, black/blacken, red/redden, green/make green, blue/make blue, brown/make brown
  - e. *Physical Property*: cool/cool, cold/make cold, warm/warm, hot/heat up, dirty/dirty, dry/dry, wet/wetted, straight/straighten, hard/harden (tough/toughen), soft/soften, tight/tighten, clear/clear, clean/clean, smooth/smooth, sharp/sharpen, sweet/sweeten, weak/weaken, strong/strengthen
  - f. *Speed*: fast/speed up, slow/slow down
  - g. *Human Propensity*: angry/anger, calm/calmed, scared/scare (frightened/frighten), sick/sicken, sad/sadden (depressed/depress), hurt/hurt, tired/tire, embarrassed/embarrass, entertained/entertain, surprised/surprise, worried/worry, pleased/please

(3) **Result Roots**
  - a. *Entity-specific Change of State*: burned/burn, melted/melt, frozen/freeze, decayed/decay (rotten/rot), swollen/swell, grown/grow, bloomed/bloom (flowered/flower, blossomed/blossom), withered/wither (wilted/wilt), fermented/ferment, sprouted/sprout (germinated/germinate), rusted/rust, tarnished/tarnish
  - b. *Cooking Verbs*: cooked/cooked (baked/bake, fried/fry, roasted/roast, steamed/steam), boiled/boil
  - c. *Breaking Verbs*: broken/break, cracked/crack, crushed/crush, shattered/shatter, split/split, torn/tear (ripped/rip), snapped/snap
  - d. *Bending Verbs*: bent/bend, folded/fold, wrinkled/wrinkle, creased/crease
  - e. *Verbs of Killing*: dead/killed/kill, murdered/murder, drowned/drown
  - f. *Destroying Verbs*: destroyed/destroy (ruined/ruin)
  - g. *Verbs of Calibratable Change of State*: go up (raised/rise, ascended/ascend, increased/increase, gained/gain), go down (fallen/fall, dropped/drop, descended/descend, decreased/decrease, declined/decline)
  - h. *Verbs of Inherently Directed Motion*: come/came, gone/go, go in (entered/enter), go out (exited/exit), returned/return

- There are morphological and semantic arguments that while PC change-of-state verbs are built on state-denoting roots lacking templatic entailments, result root verbs are not, contra the BTR and assumptions in the literature (e.g., Hale and Keyser 2002, Embick 2004).

> We show that result roots but not PC roots entail change, violating the BTR.

3 Morphological observations

- One morphological prediction of the BTR is that barring lexical idiosyncrasy all roots of change-of-state verbs should show all of the same stative forms.

- English PC roots have two stative forms: a simple adjective and a deverbal *–en* one.

  (4) a. Look at the bright picture on your left. (=camera took a bright picture)
       b. Look at the brightened picture on your left. (e.g. a digitally brightened picture)

- Embick (2004) analyzes these as the same root occurring in two adjectivalizing contexts: just a root with adjectivalizing Asp head, or a verbal structure also including v_{becom}:

  (5) a. Basic states (cp. Embick 2004: 363): [$_\text{AspP}$ Asp $\sqrt{\text{Root}}$]
       b. Result states (cp. Embick 2004: 367): [$_\text{AspP}$ Asp$_R$ [$_{vP}$ DP v_{become} $\sqrt{\text{Root}}$]]

- Crucially, with result roots there is just one morphological form, the *–en* form.

  (6) broken, chipped, cracked, crashed, crushed, fractured, ripped, shattered, smashed, snapped, splintered, split, torn, baked, barbecued, blanched, boiled, braised, ...

- Under the BTR, any stative root should appear in either of (5), yet result roots seem to not appear in (5a). Embick (2004: 358) claims that they do, but what makes result roots different is that *-ed/en* realize both Asp and Asp$_R$ with them, while with PC roots only Asp$_R$ is *-ed/en* and Asp is null. This is considered an accident of English morphology.

  > We show below that this is not an accident: this pattern recurs across languages.

4 The lexical semantics of the two kinds of roots

- The BTR gives rise to predictions about the derivatives of roots of change of state verbs:

  (7) a. Simple adjectives (e.g. *red*) will not entail prior change.
       b. Derived adjectives from PC roots (e.g. *reddened*) will entail prior change.
       c. Result root adjectives will not entail prior change (owing to the (5a) reading).

- The predictions in (7a,b) seem to be borne out:

  (8) a. The red dirt has never (been) reddened.
       b. The bright photo has never (been) brightened.
  (9) a. #The reddened dirt has never (been) reddened.
       b. #The brightened photo has never (been) brightened.

- The prediction in (7c) is not — such adjectives entail a change of the kind named by the verb they are derivationally related to (Koontz-Garboden 2005, 2010, Deo et al. 2011).

  (10) a. #The shattered vase has never (been) shattered.
        b. #The cooked chicken has never (been) cooked.

- Now, there are the "derived statives" of Nedjalkov and Jaxontov (1988):

  (11) . . . this paper provides a guide for writing letters that extend below the baseline. Internal **broken** lines serve as a reference for writing half-space letters.
        (http://www.abledata.com/abledata.cfm?pageid=19327&top=11104&ksectionid=0

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- Two quick observations: (i) such uses are the exception amongst Levin's *break* verbs; very few allow them, (ii) for each such use, there is a corresponding verbal usage with the same reading (Deo et al. 2013), i.e. (11) is *semantically* deverbal (Koontz-Garboden 2010).

  (12) ONE suggestion on ur story, it's hard to read when the line suddenly **breaks** off and u hav to go down a line in the middle of a sentence, to make it flow easier ... (http://www.fanfiction.net/r/6766517/)

- Furthermore, with these forms there is still change, albeit not temporal. In (11) it is measured along a spatial scale (Gawron 2009), though atemporal change measured along non-spatial scales is also possible (Deo et al. 2011, 2013). That there is atemporal change is easiest to see with minimal pairs of PC roots in simple and deverbal adjectival forms:

  (13) Context: I65 freeway between Chicago and Indianapolis, with Lafayette in between.
      a. I65 is wide at Lafayette city center. In fact, it's of the same width for its entire extent. (No temporal change; Spatial change can be denied)
      b. I65 was built with a widened portion at Lafayette city center, owing to all of the traffic there. (No temporal change; spatial change)
      c. #I65 is widened at Lafayette city center. In fact it's of the same width for its entire extent. (Spatial change cannot be denied)

- No minimal pairs are available to so clearly draw out the contrast with *break*-type roots (see §2), but the intuition is clear—even in their atemporal uses, change is entailed.

  (14) a. $========= W ===============$
      The double line is broken at W.
      b. $--------- W ===============$
      #The double line is broken at W.

- Thus there is still "change". Now, this could just be a fluke of English. Maybe some roots for some reason always require a v_{become} head for categorization, or something like that.

- But we also see a split in *again* modification. PC root verbs are well-known to allow both restitutive and repetitive interpretations with *again*, supposedly due to a scopal ambiguity.

  (15) John flattened the rug again.
      a. $[_{v\text{P}}$ John $[_{v'}$ v_{cause} $[_{v\text{P}}$ the rug $[$ *-en*$_{v_{\text{become}}}$ $[\sqrt{flat}$ again $]]]]]$ (restitutive)
      b. $[[_{v\text{P}}$ John $[_{v'}$ v_{cause} $[_{v\text{P}}$ the rug $[$ *-en*$_{v_{\text{become}}}$ $\sqrt{flat}$ $]]]]$ again $]$ (repetitive)

- But as Rappaport Hovav (2010: 7) and Beavers and Koontz-Garboden (2012: 358) observe, result roots do not allow pure restitutive readings, having only a repetitive reading:

  (16) a. John thawed the meat again.   (necessarily two thawings)
      b. John melted the soup again.   (necessarily two meltings)
      c. John drowned the zombie again.   (necessarily two drownings)

- This is very difficult to analyze on a decompositional approach.

> Result and PC roots are not semantically uniform.

5   Cross-Linguistic Study

- The data above though are from English only. Could it be that these are exceptions to the BTR but they are limited and rare, and do not point to a general trend? We explore this next.

5.1   Morphology

- Our methodology was to take a balanced language sample and check for the existence of simple statives based on the root meanings discussed above in those languages.

- We targeted the WALS 100 Language list (Dryer and Haspelmath 2013). In cases where we lacked sufficient grammatical and dictionary resources, we substituted languages from the WALS 200 list, and also added in a few others based on available resources or native speakers/fieldworkers. The final total was 88 languages, mostly covering the areas and families of the WALS 100, for the 85 root meanings in (2) and (3) (see §A for languages).

- We used the English adjectives/verbs (or equivalents in an appropriate source language for some resources) as translation terms to begin dictionary searches (looking in both directions). We did not assume all translations were perfect, just that the meanings were similar enough to justify the word as being in the same broad and medium-grained semantic categories.

- We collected paradigms of simple state-inchoative-causative-result state (e.g. *red-redden-redden-reddened*) for translations of the roots we examined in English, plus also any underlying root for languages in which such paradigms are based on a shared bound root:

(17)
Language	underlying root	simple state	inchoative	causative	result state
Tenango Tzeltal	—	*tut*	*tut-ub*	*tut-ub-tes*	*tut-ub-en*
		'small'	'shrink'	'shrink'	'shrunken'
Oromo	*dheer-*	*dheer-aa*	*dheer-addh*	*dheer-essuu*	—
	'long'	'long'	'become long'	'lengthen'	

- We privileged lexicalized terms over productively derived terms, and morphologically derived terms over periphrastically derived terms, motivated by a general tendency across languages for more lexical(ized) forms to be "normal" or "default" expressions (see e.g. the literature on causatives such as Shibatani 1976, Shibatani and Pardeshi 2001, Harley 2008).

- If a form was unattested but our resources gave productive processes for deriving it, we constructed a hypothetical form (marked by @ so it could be left out of the analysis if need be). This was needed for highly agglutinating languages such as Kiowa where some dictionaries give roots and rules rather than full lists of forms (Watkins and McKenzie 1984: 153):

(18)
| Language	underlying root	simple state	inchoative	causative	result state
Kiowa		*ét*	@*ét-ɔ́m-gyá*	@*ét-ɔ́m*	@*ét-dɔ́·*
		'big'	'enlarge'	'enlarge'	'enlarged'

- The ultimate preference rankings for the forms we collected were:

(19)   attested lexicalized form > attested productive morphological form > hypothetical productive morphological form > attested periphrastic form > hypothetical periphrastic form > no data
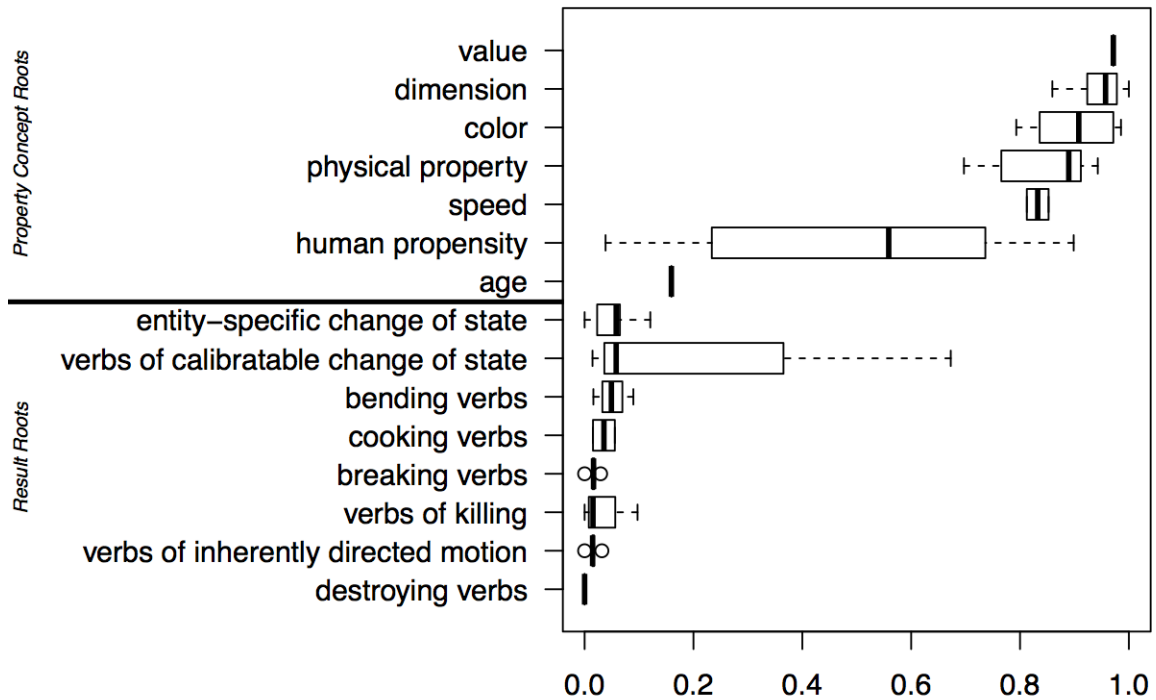
- To place the forms of a root in the paradigm we could have used either morphology or translation. For consistency we chose translation, e.g. if a stative term was translated 'broken' we listed it as a result state term. But we also coded morphological relationships between forms (labile, suppletive, equipollent, derived from/input to, unrelated) plus information about the forms to reconstruct a morphological classification. Rarely though was there a mismatch.

- We have to date collected full data on 73 languages, and the main overall pattern holds: from a simple visual inspection it is clear PC roots overwhelmingly tend to have simple stative forms (that usually serve as input to the rest) and result roots overwhelmingly tend not to (though there are exceptions in both directions), e.g. the following is typical:

(20)

Language	underlying root	simple state	inchoative	causative	result state
Tenango Tzeltal		*tut*	*tut-ub*	*tut-ub-tes*	*tut-ub-en*
		'small'	'shrink'	'shrink'	'shrunken'
Tenango Tzeltal			*chijk'*	*chik'*	*chijk'-em*
			burn	burn	burned

- A statistical analysis confirms this, though we had to make the following assumption owing to the fact that a missing form could either be non-existent or just unattested in our resources:

    - We ignored any root meanings for which we had no data in a given language; this we assumed was not having the data (e.g. we were unable to find any data for a root meaning 'hurt' in Anejom̃, so we assumed we had a gap in the dictionary).

    - Otherwise, the methodology was to look at each remaining root and calculate for it the percentage of languages for which the simple state was attested.

    - If a root meaning corresponded to several apparent synonymys, for purposes of our statistical analysis we took one random synonym.

- We ended up with 3,120 PC and 2,241 result root paradigms, for a total of 5,361 paradigms.

- We checked that the mean percentages of attested simple states for PC and result roots (and deviation from the mean) were significantly different. The results were striking and statistically significant (on a Mann Whitney U-test on the proportion of simple statives for PC and result roots; $p < 0.001$) (nothing changed when dropping hypotheticals):

proportion filled simple states across language sample
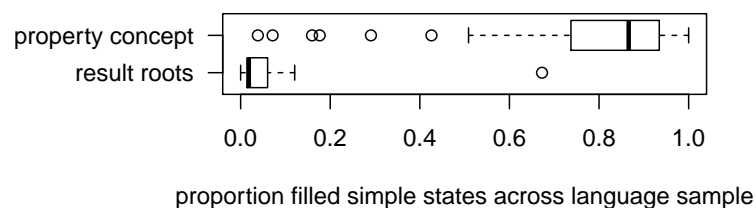
- We also did a similar comparison across root subclasses (and the difference was again significant on a one-way ANOVA across all subclasses; $p < 0.001$):

Property Concept Roots

- value
- dimension
- color
- physical property
- speed
- human propensity
- age

Result Roots

- entity–specific change of state
- verbs of calibratable change of state
- bending verbs
- cooking verbs
- breaking verbs
- verbs of killing
- verbs of inherently directed motion
- destroying verbs

0.0 0.2 0.4 0.6 0.8 1.0

proportion filled simple states across language sample

- The trend seems clear, though some noteworthy observations:

  - Age is the one PC root that patterns like a result root. We realized in hindsight that 'old' is semantically like a result root — one cannot be old without having started young. (*Old* is thus a rare English adjective that entails change. This is not surprising: *old* is historically deverbal, from the past participle of Old English *alan* 'nourish, grow'.)

  - The other stand out is human propensity. Here there was a semantic category issue: the class is quite broad and encompasses many transitive forms that were purely stative (e.g. experiencer subject verbs like *fear*) and derived forms that did not obviously fir the semantic patterns we set out to find.

> **Crosslinguistic morphological generalization**: State-denoting words based on result roots don't exist in the morphological form that PC roots do. The former tend to lack simple stative forms, the latter have them. It is thus not an accident of English.

5.2 Semantics

- To test the semantic predictions cross-linguistically we choose opportunistic in-depth studies, using Kinyarwanda (Northeastern Bantu; Rwanda) and Kakataibo (Panoan; Eastern Peru) as case studies (see Jerro 2017 and Valle et al. 2017, respectively), to which we can also add the English data above.

5.2.1 Kakataibo

- Kakataibo is reasonably well-behaved: simple states and result states are adjectives and inchoatives and causatives are verbs, evidenced e.g. by inflectional morphology.

- Simple states and inchoatives are usually labile, and causatives generally formed by causative *-o* (though there were also some anticausative and equipollent relationships). Result states are formed by factive *-kë*, and (somewhat uniquely among the languages we examined) distinguish result state forms from inchoatives and causatives:[1]

(21)

Language	underlying root	simple state	inchoative	causative	result state
Kakataibo	—	*ani*	*ani*	*ani-o*	*ani-kë/ani-o-kë*
		'large'	'enlarge'	'enlarge'	'enlarged (inch/caus)'
	—	—	*churi*	*churi-o*	*churi-kë/churi-o-kë*
			'wrinkle'	'wrinkle'	'wrinkled'

- We did not consider the full list in (2) and (3) due to lexical gaps and difficulties in cultural context, but instead the following were examined:

(22) **Property Concept**: *xo paxada* 'yellow', *ani* 'big, *upi(t)* 'pretty, beautiful', *tuna(n)* 'black', *uxu(a)* 'white', *inru* 'hard', *xana* 'hot', *bata* 'sweet', *bachu* 'soft', *ˈaidama* 'bad', *bënsi(t)* 'thin', *xëni* 'old', *chadkë(t)* 'thin', *chabat* 'wet', *puntë(t)* 'straight', *diba(t)* 'smooth', *kacha* 'sour', *anaha* 'wide', *chukúma* 'small', *cha* 'big', *mamúa* 'round'

(23) **Result Roots**: *ëd-ki- kë* 'dry-INTR-NMLZ', *tëa-kë* 'cut-NMLZ', *nën* 'burn', *nën-kë* 'burn-NMLZ', *a-ru- kë* 'do-UP-NMLZ', *katët-kë* 'feel.embarrassed-NMLZ', *tun-ka-kë* 'shoot-TR-NMLZ', *rëtë* 'kill', *këñu* 'exterminate', *chachi* 'stab', *xui* 'barbecue', *sasa-ka* 'fry-TR', *musa* 'mix/stir/mash'

- PC vs. result roots show the distinction regarding change entailments:

(24) a. *báinka   ani ˈikë   ˈaibika   uini   abi   ni*
       báin=ka=a   ani ˈikë   ˈai=bi=ka=a   uini   a=bi   ni
       hill=VAL=3A/S big be.3.IPFV then=EMPH=VAL=3A/S INDF.PRO 3=EMPH nor

   Diosabi   ni uni yubë   unibi   anioima.
   Diosabi   ni uni yubët   uni=bi   ani-o-i-i=ma.
   God=EMPH nor man sorcerer man=EMPH big-FACT-IPFV=PROX=NEG
   'The hill is big, but nobody nor God nor a sorcerer made it big.'

   b. **ñu   nami tëakë   ˈikë   ˈaibika   uini*
      ñu   nami tëa-kë   ˈikë   ˈaibika   uini
      thing flesh cut=NFUT.NMLZ be.3.IPFV then=EMPH=VAL=3A/S INDF.PRO

   abi   tëakëma   ˈikë.
   abi   tëa-kë=ma   ˈikë.
   3=EMPH cut=NFUT.NMLZ=NEG be.3.IPFV
   'The meat is cut but nobody cut it.'

- PC roots generally allow restitutive readings under iterative *-tëkën* marking, while result roots usually resist them (though admittedly it was hard in some cases to come up with what the simple state even would be, as with cooking verbs)

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[1] 3=third person, A=subject of transitive verb, EMPH=emphatic, FACT=factitive, INDF=indefinite, INTR=intransitive, IPFV=imperfective, ITR=iterative, NEG=negation, NFUT.NMLZ=non=future nominalizer, POSS=possessive, PRO=pronoun, PROX=proximate, S=subject of intransitive verb, UP=up, VAL=validational

(25) a. [The desert starts off dry. Then, it is made non-dry. Then it turns dry again.]

 madin *papanka*   *ëdkitëkënia.*
 madi=n papa=n=ka=a   ëd-ki-tëkën-i-a.
 sand=POSS father=A/S=VAL=3A/S dry-INTR-ITR-IPFV=N.PROX

 'The desert is getting dry again.'

 b. [The man picks up a banana, which is edible. A wizard makes it inedible. The man fries the banana and makes it edible again.]

 #uninka   *nodi* *sasakatëkënia.*
 uni=n=ka=a   nodi sasa-ka-tëkën-a-x-a
 man=A/S=VAL=3A/S banana fry-TR-ITR-PFV-3-N.PROX

 'The man fried the banana again.'

5.2.2 Kinyarwanda

- In Kinyarwanda we see something similar (here we checked as many of the roots in (2) and (3) as possible; these are in §B). However, one complication is that barring a few exceptions, both statives are always verbs (if extant at all) and always labile with the inchoative (either zero-marked with the causative derived through various means as in (26), or marked by detransitivizing *-ik/ek* with the causative unmarked), so telling them apart is tricky.

(26) a. *Icy-uma ki-ra-**tyay**-e.*
  7-knife 7S-PRES-sharp-PRFV

  'The knife is sharp.'   (Simple State Reading)

 b. *Icy-uma cy-a-**tyay**-e.*
  7-knife 7S-PST-sharp-PRFV

  'The knife sharpened.'   (Inchoative Reading)

 c. *Umu-gabo a-ri gu-**tyaz**-a icy-uma.*
  1-man 1S-COP INF-sharpen-IMP 7-knife

  'The man is sharpening the knife.'   (Causative Reading)

 d. *M-perez-a   icy-uma gi-**tyay**-e.*
  1SGs-hand/pass-IMP 7-knife 7S-sharp-PRFV

  'Give me the sharpened knife.'   (Result State Reading)

- Fortunately (and confusingly) the tense/aspect inflection provides some disambiguation strategies, where (roughly) past+perfective and present+imperfective combinations are purely inchoative while present+perfective combinations are stative:

(27)

reading	tense prefix	gloss	aspect suffix	gloss
distant past inchoative	*ara–*	'dist. past'	*–e*	'perfective'
recent past inchoative	*a–*	'recent past'	*–e*	'perfective'
present stative	*ra–*	'present'	*–e*	'perfective'

(28) a. *Ubu-ki   bu-ra-ryoshy-e.*
   14-honey 14S-PRES-sweet-PRFV

   'The honey is sweet.'   (stative)

  b. *Umu-vinyo w-a-ryoshy-e.*
   3-wine 3S-PST-sweet-PRFV

   'The wine became sweet.'   (inchoative)

- This is shown by *cya–* 'still', which occurs with states but not events (cf. Kratzer 2000).

(29) a. *N-da-cya-rakay-e.*
   1SGS-PRES-STILL-angry-PRFV

   'I am still angry.'

  b. **N-a-cya-rakay-e.*
   1SGS-PST-STILL-angry-PRFV

   Intended: 'I was still angry.'

- Given this distinction, PC and result roots differ as expected. The latter entail change in stative forms, the former do not:

(30) a. *Iki   cy-uma   ki-ra-tyay-e,   ariko ntikigezwe gi-tyaz-w-a.*
   7.this CL7-knife 7S-PST-sharp-PRFV but   never   7S-sharpen-PASS-FV

   'This knife is sharp, but it was never sharpened.'

  b. *#In-yama zi-ra-konjorots-e,   ariko ntizigezwe z-a-konjorok-a.*
   10-meat 10S-PRES-thaw-PRFV but   never   10S-PST-thaw-IMP

   'The meat is thawed, but it never thawed.'

- Finally, restitutive and repetitive modification works about the same again:

(31) a. *Icy-uma cy-ongey-e   gu-tyar-a.*
   7-knife 7S-again-PRFV INF-sharp-IMP

   'The knife got sharp again'.

   $\sqrt{}$: Restitutive Reading (it is sharpened it for the first time)

   $\sqrt{}$: Repetitive Reading: (someone sharpened it before)

  b. *In-yama z-∅-ongey-e   zi-ra-konjorok-a.*
   10-meat 10S-PST-again-PRFV 10S-PRES-thaw-IMP

   'The meat thawed again.'

   $\sqrt{}$: Repetitive Reading (the meat thawed, froze, and thawed again)

   #: Restitutive Reading (the meat is frozen and is thawed for the first time)

Upshot: While PC roots behave as predicted by the BTR having a purely stative meaning, result roots always have an entailment of change, a fact that holds up across languages.

6 Conclusions and Consequences

- PC and result roots differ consistently across languages in terms of the inferences they generate and their morphological behavior. This clearly violates the BTR:

  - Under the BTR the roots of result verbs should lack entailments of change and a form based on them would have to acquire one through addition of a v_{become} head.

  - This predicts that in contexts without v_{become} the change entailment should not arise.

  - Statives are such contexts, yet the entailment is there, violating the BTR.

  - Furthermore, on the analysis consistent with the BTR *again* modifiers should have access to the root below v_{become}, but this also does not arise.

  - Morphologically, in at least *some* languages result roots should have simple stative forms, i.e. where the stativizer is null. This rarely happens, and clearly not to the degree it does with PC roots.

- So what would explain these data? A simple analysis would be to assume that roots of PC verbs and result root verbs differ in that the former describe simple states and the latter states for which it is also entailed that there exist a cause:

  (32)   a. $[\![\sqrt{\mathrm{flat}}]\!] = \lambda x \lambda s [flat'(x,s)]$

             b. $[\![\sqrt{\mathrm{crack}}]\!] = \lambda x \lambda s [not.together'(x,s) \wedge \exists e'[become'(e',s)]]$

- Defining v_{become} as in (33a) and combining it with (32) derives the inchoatives in (33b,c).

  (33)   a. $[\![v_{become}]\!] = \lambda P \lambda x \lambda e \exists s[become'(e,s) \wedge P(x,s)]$

             b. $[\![v_{become} \sqrt{\mathrm{flat}}]\!] = \lambda x \lambda e \exists s[become'(e,s) \wedge flat'(x,s)]$

             c. $[\![v_{become} \sqrt{\mathrm{crack}}]\!] = \lambda x \lambda e \exists s[become'(e,s) \wedge not.together'(x,s) \wedge \exists e'[become'(e',s)]]$

- The change-of-state use of the PC root only entails change by virtue of v_{become}, but the *crack* root has the entailment itself regardless of whether there's v_{become}.

- This predicts other uses of the root without v_{become} will generate the entailment, and that *again* modification, even modifying the root alone, will still scope over a change entailment.

- This does not capture the morphological asymmetry. However, default Spell-Out rules for Asp and *v* heads might explain this (overridden by root-specific rules as with *old*):

  (34) Default Spell-Out for v_{become} for its complement root $\sqrt{\mathrm{R}}$:
        a. If $\sqrt{\mathrm{R}}$ entails change, then -∅
        b. If $\sqrt{\mathrm{R}}$ does not entail change, then *-en/ed*

  (35) Default Spell-Out for Asp for its complement XP (root $\sqrt{\mathrm{R}}$ or *v*P):
        a. If XP does not entail change, then -∅
        b. If XP entail change, then *-en/ed*

- This has a functional motivation: the two categories are unmarked for opposite meanings.

- However, these rules go against the grain of standard event structural approaches, whereby regular morphological rules should not be sensitive to root semantics. Yet it seems clear that the pattern governing the overt realization must be contingent on root semantics, suggesting the overall correctness of our analysis, arguing against that aspect of event structural theories.

- In sum, the root carries an entailment that can be elsewhere introduced templatically, and it can matter grammatically. This is inconsistent with the BTR.

- The deeper question is *why* this split should exist at all, and why consistently across broad meaning category types. Here we believe there is a kind of conceptual explanation: there are kinds of states out there which are conceived of as just occurring naturally, and another type which are conceived of as being the outcome of processes.

- Given that the latter involves a type of meaning that figures into the grammars of languages (e.g. in the existence of v_{become} heads) it is not inconceivable that those roots would show patterning like the functional elements absent the functional elements themselves.

7 Acknowledgments

A Languages

- Here is the full of list languages we investigated (those marked with * were not included in our preliminary statistics):[2]

Eurasia Basque (Basque)
*Burmese (Burmese-Lolo, Sino-Tibetan)
Mandarin (Chinese, Sino-Tibetan)
*Meithei (Kuki-Chin, Sino-Tibetan)
*Burushaski (Burushaski)
*Chukchi (Northern Chukotko-Kamchatkan, Chukotko-Kamchatkan)
English (Germanic, Indo-European)
German (Germanic, Indo-European)
Modern Greek (Greek, Indo-European)
Persian (Iranian, Indo-European)
Russian (Slavic, Indo-European)
Spanish (Romance, Indo-European)
French (Romance, Indo-European)
Hindi (Indic, Indo-European)
Finnish (Finnic, Uralic)

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[2]All macroareas and genetic affiliations are taken from WALS. Each language is listed with its genus and family, except where those are the same.

Georgian (Kartvelian)
Modern Hebrew (Semitic, Afro-Asiatic)
Japanese (Japanese)
*Kannada (Southern Dravidian, Dravidian)
Khalkha (Mongolic, Altaic)
Korean (Korean)
Lezgian (Lezgic, Nakh-Daghestanian)
Thai (Kam-Tai, Tai-Kadai)
Turkish (Turkic, Altaic)
Vietnamese (Viet-Muong, Austro-Asiatic)

Africa Acholi (Nilotic, Eastern Sudanic)
*Egyptian Arabic (Semitic, Afro-Asiatic)
Middle Atlas Berber (Berber, Afro-Asiatic)
*Hausa (West Chadic, Afro-Asiatic)
Harar Oromo (Lowland East Cushitic, Afro-Asiatic)
Gújjolaay Eegimaa (Bak, Niger-Congo)
Swahili (Bantoid, Niger-Congo)
*Kinyarwanda (Bantoid, Niger-Congo)
Zulu (Bantoid, Niger-Congo)
Sango (Ubangi, Niger-Congo)
Yoruba (Defoid, Niger-Congo)
Khoekhoe (Khoe-Kwadi)
Koyraboro Senni (Songhay)
Malagasy (Barito, Austronesian)

North America Plains Cree (Algonquian, Algic)
Hopi (Hopi, Uto-Aztecan)
Yaqui (Cahita, Uto-Aztecan)
Jakaltek (Mayan)
Tenango Tzeltal (Mayan)
Karok (Karok)
Kiowa (Kiowa-Tanoan)
Koasati (Muskogean)
*Kutenai (Kutenai)
Lakhota (Core Siouan, Siouan)
Chalcatongo Mixtec (Mixtecan, Oto-Manguean)
*Mezquital Otomí (Otomian, Oto-Manguean)
Navajo (Athapaskan, Na-Dene)
Oneida (Northern Iroquoian, Iroquoian)
Rama (Rama, Chibchan)
Yup'ik (Eskimo, Eskimo-Aleut)
Zoque (Mixe-Zoque)

South America	Barasano (Tucanoan)
	Carib (Cariban)
	Guaraní (Tupi-Guaraní, Tupian)
	Minica Huitoto (Huitoto, Huitotoan)
	Kakataibo (Cashibo-Cacataibo, Panoan)
	Mapudungun/Mapuche (Araucanian)
	*Mocoví (South Guaicuran, Guaicuran)
	Paumarí (Arauan)
	Huallaga Quechua (Quechuan)
	Warao (Warao)
	*Yagua (Peba-Yaguan)
Papunesia	Alamblak (Sepik Hill, Sepik)
	Kwoma (Middle Sepik, Sepik)
	Anejom (Oceanic, Austronesian)
	Bariai (Oceanic, Austronesian)
	Fijian (Oceanic, Austronesian)
	Hawaiian (Oceanic, Austronesian)
	Chamorro (Chamorro, Austronesian)
	Indonesian (Malayo-Sumbawan, Austronesian),
	Paiwan (Paiwan, Austronesian)
	Tagalog (Greater Central Philippine, Austronesian)
	Lower Grand Valley Dani (Dani, Trans-New Guinea)
	Kewa (Engan, Trans-New Guinea)
	Koiari (Koiarian, Trans-New Guinea)
	Daga (Dagan)
	*Oksapmin (Oksapmin)
Australia	Gooniyandi (Bunuban)
	Kayardild (Tangkic, Tangkic)
	Martuthunira (Western Pama-Nyungan, Pama-Nyungan)
	Pintupi (Western Pama-Nyungan, Pama-Nyungan)
	*Murrinh-Patha (Murrinh-Patha, Southern Daly)
	Tiwi (Tiwian)

B Kinyarwanda Roots

English Gloss	State (Simple/Result)	Inchoative	Causative
large/big/enlarge	/nini	kw-iyongera	k-ongera
small/shrunk/shrink	/toya		ku-gabanya
short/shorten	/gufi	kw-ihina	ku-gabanya
long/lengthen	/re-re	kw-iyongera	k-ongera
deep/deepen	/re-re	gu-tebera	k-ongera
wide/widen	/gari	kw-iyongera	k-ongera
tall/height/heighten	/-re-re	ku-bara -re-re	k-ongera
aged/age	gu-saza	gu-saza	
bad/worse/worsen	/bi	ku-bara mbikurushaho	
good/improved/improve	/iza	kw-iyongera	
white/whiten	kw-era		
white/whiten	umweru	gu-hinduka umweru	
black/blacken	umukara	gu-hinduka umukara	
red/redden	umutuku	gu-hinduka umutuku	
green/make green	icyatsi	gu-hinduka icyatsi	
blue/make blue	ubururu	gu-hinduka ibururu	
brown/make brown	ikaki	gu-hinduka igitaka	
cold/make cold	gu-konja	gu-konja	gu-konjesha
hot/heat up	gu-shyuha	gu-shyuha	gu-shyushya
dirty/dirty	umwanda		
dirty/dirty	kw-andura	kw-andura	kw-anduza
dry/dry	ku-ma	ku-ma	ku-misha
wet/wetten	gu-toha	gu-toha	gu-tosa
straight/straighten	ku-gororoka		ku-gorora
hard/harden	gu-komera	gu-komera	
soft/soften	k-oroha	k-oroha	k-oroheza
clean/clean	gu-sukura	gu-sukura	gu-sukura
sharp/sharpen (a point)	gu-songora		gu-songora
sharp/sharpen	gu-tyara	gu-tyara/gu-tyaza	gu-tyaza
sweet/sweeten	ku-ryoha	ku-ryoha	ku-ryoheza
strong/strengthen	gu-komera	gu-komera	gu-komeza
fast/speed up	kw-ihuta	k-ongera umuvuduko	kw-ihutisha
slow/slow down	buhoro	ku-gabanya umuvuduko	
angry/anger	ku-rakara	ku-rakara	ku-rakaza
calm/calmed	kw-ikaruma	kw-ikaruma	gu-karumisha
frightened/frighten	gu-tinya	gu-tinya	gu-tinyisha
sick/sicken	ku-rwara	ku-rwara	
sad/sadden	ku-babara	ku-babara	ku-babaza
hurt/hurt	ku-babara	ku-babara	ku-babaza
tired/tire	ku-nanirwa	ku-nanirwa	ku-naniza
entertained/entertain	ku-nezerwa	ku-nezerwa	ku-nezeza
surprised/surprise	gu-tungurwa	gu-tungurwa	gu-tungura
worried/worry	ubwoba		
pleased/please	kw-ishima	kw-ishima	gu-shimisha

English Gloss	Simple State	Inchoative	Causative	Result State
burned/burn		gu-shiririra	gu-shiririza	gu-shiririra
melted/melt		gu-shonga	gu-shongesha	
congeal		gu-fata	gu-fatisha	gu-fata
decayed/decay, rotten/rot		ku-bora	ku-boza	
swollen/swell			ku-byimbisha	ku-byimba
grown/grow		gu-kura	gu-kuza	
bloomed/bloom		ku-bumbura		ku-bumbura
wilted/wilt		ku-raba	ku-rabiza	ku-raba
withered/wither		ku-raba	ku-rabiza	ku-namba
sprouted/sprout		gu-tunguka		gu-tunguka
tarnished/tarnish		gu-koboka		
roast/roasted			k-otsa	
cook/cooked			gu-teka	gu-tek-ek-a
fry/fried		gu-karang-w-a	gu-karanga	gu-karang-ik-a
broken/break		ku-men-ek-a	ku-mena	ku-men-ek-a
cracked/crack		gu-saduka	gu-satura	
crushed/crush		gu-hond-ek-a	gu-honda	gu-hond-ek-a
shattered/shatter		gu-shwanyuka	gu-shwanyura	
torn/tear, ripped/rip		gu-c-ik-a	gu-ca	gu-c-ik-a
snapped/snap		ku-vun-ik-a	ku-vuna	ku-vun-ik-a
bent/bend		ku-gonda	ku-gonda	ku-gond-ek-a
folded/fold			gu-hina	
wrinkled/wrinkle		kw-ihinarika	gu-hinarika	
dead/killed/kill		gu-pfa	kw-ica	gu-pfa
drowned/drown		ku-rohama	kw-ibiza	ku-rohama
destroyed/destroy, ruined/ruin		kw-angir-ik-a	kw-angiza	kw-angir-ik-a
go up		ku-zamuka	ku-zamura	
go down		ku-manuka	ku-manura	
differing/differ		gu-tandukanya	gu-tandukanya	
come/came		ku-za	ku-zana	
gone/go		ku-genda	ku-jyana	
go in (entered/enter)		kw-injira	kw-injiza	
go out (exited/exit)		gu-sohoka	gu-sohora	
returned/return		gu-subira	gu-subiza	

References

Arad, Maya. 2005. *Roots and Patterns: Hebrew Morpho-Syntax*. Dordrecht: Springer.

Beavers, John and Andrew Koontz-Garboden. 2012. Manner and result in the roots of verbal meaning. *Linguistic Inquiry* 43(3):331–369.

Beavers, John and Andrew Koontz-Garboden. In prep. *The Meaning of Verbal Roots and the Roots of Verbal Meaning*. Unpublished Ms., The University of Texas at Austin and The University of Manchester.

Borer, Hagit. 2005. *Structuring Sense, Vol. I and II*. Oxford: Oxford University Press.

Deo, Ashwini, Itamar Francez, and Andrew Koontz-Garboden. 2011. The morphosemantics of –*ed*. Paper presented at Dimensions of grammar in honor of Paul Kiparsky. Konstanz, August 3, 2011.

Deo, Ashwini, Itamar Francez, and Andrew Koontz-Garboden. 2013. From change to value dif-

ference in degree achievements. In *Proceedings of Semantics and Linguistic Theory 23*, pages 97–115. Ithaca, NY: CLC Publications.

Dixon, R.M.W. 1982. *Where have all the adjectives gone?*. The Hague: Mouton.

Dowty, David. 1979. *Word meaning and Montague grammar*. Dordrecht: D. Reidel Publishing.

Dryer, Matthew S. and Martin Haspelmath, eds. 2013. *WALS Online*. Leipzig: Max Planck Institute for Evolutionary Anthropology.

Dunbar, Ewan and Alexis Wellwood. 2016. Addressing the "two interface" problem: Comparatives and superlatives. *Glossa* 1(1):1–29.

Embick, David. 2004. On the structure of resultative participles in English. *Linguistic Inquiry* 35(3):355–392.

Embick, David. 2009. Roots, states, and stative passives. Talk given that the 2009 Roots Workshop, Stuttgart.

Gawron, Mark. 2009. The lexical semantics of extent verbs. San Diego State University, January 31, 2009.

Goldberg, Adele E. 1995. *Constructions: A Construction Grammar Approach to Argument Structure*. Chicago, IL: University of Chicago Press.

Hale, Kenneth L. and Samuel Jay Keyser. 2002. *Prolegomenon to a Theory of Argument Structure*. Cambridge, MA: MIT Press.

Harley, Heidi. 2008. On the causative construction. In S. Miyagawa and M. Saito, eds., *The Handbook of Japanese Linguistics*, pages 20–53. Oxford: Oxford University Press.

Jerro, Kyle. 2017. Change-of-state verb roots in Kinyarwanda. Paper presented at the Linguistic Society of America 91st Annual Meeting, Austin, TX.

Koontz-Garboden, Andrew. 2005. On the typology of state/change of state alternations. *Yearbook of Morphology* 2005:83–117.

Koontz-Garboden, Andrew. 2006. The states in changes of state. In press Proceedings of the 32nd annual meeting of the Berkeley Linguistics Society.

Koontz-Garboden, Andrew. 2010. The lexical semantics of derived statives. *Linguistics and Philosophy* 33:285–324.

Kratzer, Angelika. 2000. Building statives. In *BLS 26*, pages 385–399.

Levin, Beth. 1993. *English verb classes and alternations*. Chicago, IL: University of Chicago Press.

Levin, Beth and Malka Rappaport Hovav. 1995. *Unaccusativity: At the Syntax-Lexical Semantics Interface*. Cambridge, MA: MIT Press.

Marantz, Alec. 1997. No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. In *Proceedings of the 21st Annual Penn Linguistics Colloquium*, vol. 4.2 of *University of Pennsylvania Working Papers in Linguistics*, pages 201–225.

Megerdoomian, Karine. 2002. *Beyond words and phrases: A unified theory of predicate composition*. Ph.D. thesis, University of Southern California, Los Angeles, CA.

Nedjalkov, Vladimir P. and Sergej Je. Jaxontov. 1988. The typology of resultative constructions. In V. P. Nedjalkov, ed., *Typology of resultative constructions*, pages 3–62. Amsterdam: John Benjamins.

Rappaport Hovav, Malka. 2010. Building scalar changes. The Hebrew University of Jerusalem.

Rappaport Hovav, Malka and Beth Levin. 1998. Building verb meanings. In M. Butt and W. Geuder, eds., *The Projection of Arguments: Lexical and Compositional Factors*, pages 97–133. Stanford: CSLI Publications.

Shibatani, Masayoshi. 1976. The grammar of causative constructions: A conspectus. In M. Shi-

batani, ed., *The Grammar of Causative Constructions*, pages 1–39. New York: Academic Press.

Shibatani, Masayoshi and Prashant Pardeshi. 2001. The causative continuum. In M. Shibatani, ed., *The Grammar of Causation and Interpersonal Manipulation*, pages 85–126. Amsterdam: John Benjamins.

Valle, Daniel, John Beavers, and Andrew Koontz-Garbodden. 2017. States and change-of-state in kakataibo: The role of the root. Paper to be presented at the Society for the Study of the Indigenous Languages of the Americas.

Watkins, Laurel J. and Parker McKenzie. 1984. *A grammar of Kiowa*. Studies in the Anthropology of North American Indians. Lincoln / London: University of Nebraska Press.

Wechsler, Stephen. 2005. What is right and wrong about little-*v*. In M. Vulchanova and T. A. Åfarli, eds., *Grammar and Beyond — Essays in Honour of Lars Hellan*, pages 179–195. Oslo: Novus Press.