The asymmetry of argument structure: a view from coercion[*]

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This paper brings psycholinguistic evidence to bear on the question of how far-reaching verbal underspecification must be. Are verb roots capable of introducing theme arguments, or must this task fall to functional heads? New experimental evidence comes from causativization and the interpretation of known intransitives used transitively. In assigning grammatical structure to transitive sentences containing intransitive verbs (e.g. laugh, arrive*), subjects are more likely to build causative structures if the verb is unaccusative than if it is unergative. I argue that this finding follows naturally from an account where unaccusatives and unergatives differ in root type: unaccusative roots introduce arguments, whereas unergative roots do not. The finding is not predicted on a theory where all argument introduction is factored out in functional structure. Such results provide a bound on how underspecified verbal roots can be: theme arguments must remain root arguments, whatever else is factored out.*

In language after language we find evidence for verb classes, groups of verbs which cohere in various syntactic, semantic and morphological ways. Such results raise the question of why verbs should be sorted in this way in natural language. Why are there verb classes? Why such systematicity in verbal behavior? Recent work on the interfaces of compositional operations and lexical information proposes a simple explanation: verbs form classes because they are not themselves atomic. In virtue of commonalities in the bits of functional structure deployed with different verb roots, verbs form classes whose members share syntactic, semantic and morphological structure. That such commonalities should exist reflects a subtle optimization in language design: what can be done by combination is not typically done by memorization.

The non-atomicity of the traditional verb is manifest in a number of domains. Agreement and tense have long been taken to be factored out of verb roots (Chomsky 1981, Pollock 1989); so too have syntactic properties such as accusative case assignment (Johnson 1991) and semantic properties of causativity (Pylkkänen 2002, Deal 2006) and

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aktionsart (van Hout 1998, Borer 1998, 2004). Argument-structural information has also been attributed to functional heads (Kratzer 1996, Borer 1998, Jelinek 1998, Pylkkänen 2002); even verbal category, the mere fact of being a verb, has been dissociated from verb roots (Marantz 1997). This broad dissolution of verb meaning into functional structure has led some to suggest that verb roots may be *entirely* underspecified for syntactic and semantic properties, seeming to possess these properties only through close association with functional structure (Ramchand 2003, Borer 2004). Such a picture presents a unified account of the source of verb class information. But is it empirically correct?

The investigation of argument structural dissociation in particular has uncovered an apparent asymmetry: while there is evidence for a dissociation of agent arguments from verb roots, there does not appear to be corresponding evidence for a dissociation of theme arguments (Kratzer 1996, 2003). If this apparent asymmetry holds up to empirical scrutiny, it provides an important bound on how underspecified verbal roots can be: they may have much of their traditional lexical semantics factored out into functional structure, but theme argument-taking must remain a property of roots themselves. Verb roots, like other heads in the verbal projection, have a single possible syntactic function: the introduction of an NP.

This paper considers the potential asymmetry between agent and theme arguments in the environment where they might be most minimally contrasted: unaccusative and unergative predicates. Are these two types of intransitives asymmetric in terms of how their argument is introduced? Novel psycholinguistic evidence for asymmetry in argument structure comes from causative coercion of unaccusative and unergative verbs. Evidence is presented that subjects are more willing to productively causativize unaccusatives than unergatives, showing on-line awareness of a difference between two types of verb roots: those that introduce themes and those that do not.

1. Unaccusativity and the origin of themes

Perlmutter's (1978) seminal work on the unaccusativity hypothesis brought to light a far-reaching split between two classes of intransitive predicates, the unaccusatives and the unergatives. Subsequent research has uncovered a variety of grounds on which this distinction is evident. Only unaccusatives can form prenominal modifiers and participate in the causative alternation (see Levin and Rappaport-Hovav 1995, Alexiadou et al. 2004). Only unergatives can form impersonal passives (Perlmutter 1978), and as Kratzer (2005) argues, take resultative secondary predicates. In many Indo-European languages, unaccusatives and unergatives select different forms of the auxiliary; additional language-specific diagnostics include the possibility of *there*-insertion in English (Haegeman 1994; see Deal 2006 for discussion), *ne*-cliticization in Italian (Belletti & Rizzi 1981), and bare plural arguments in Spanish and Greek (Bever and Sanz 1997, Alexiadou et al. 2004).

While these and other diagnostics amply attest to a difference between unaccusatives and unergatives, the precise locus of the difference remains controversial.

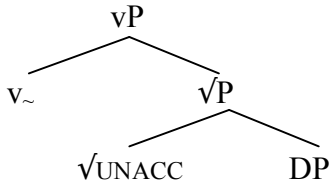
In principle, the split could arise in a variety of different parts of grammar. Here, I will discuss two main proposals for the locus of the unaccusative/unergative difference, corresponding to whether or not argument introduction is asymmetric for agents and themes.[1] The first view is an asymmetric one, allowing some but not all argument association to be factored out into functional structure (Kratzer 2003, 2005, i.a). On this view, unaccusative verb roots introduce an argument, but unergative roots do not. Argument introduction is accomplished in unergatives by means of a functional head which introduces agents:

(1) v_{AG} $\lambda x \lambda e$. Agent(x)(e) (Kratzer 1996)

The introduction of unergative arguments via a head like v_{AG} gives a picture similar to the early GB conception of unergatives as taking arguments directly in the Spec,IP subject position. Updating that view to reflect the VP-internal subject hypothesis (Koopman and Sportiche 1991), we maintain a view of unaccusative verbs as *directly* introducing arguments and unergative verbs as *indirectly* introducing them.

The asymmetric view of unaccusatives and unergatives thus presents the two types of VPs as shown below.[2]

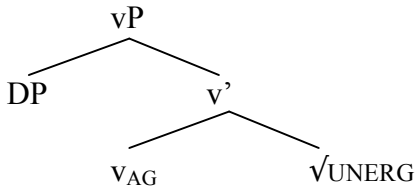
(2) Unaccusatives: verb introduces argument[3]



TR(√UNACC) = $\lambda x \lambda e$. P(x)(e)

e.g. $\lambda x \lambda e$. arrive(x)(e)

(3) Unergatives: functional head introduces argument



TR(√UNERG) = λe . P(e)

e.g. λe . laugh(e)

In line with a compositionality-driven view of the syntax-semantics interface, we find two interlocking differences between unaccusatives and unergatives. Unaccusative verb

[1] Other views not discussed here include the purely lexical semantic view, e.g. Napoli (1988). I overlook such views in the present discussion because they do not seem to provide appropriate tools for handling the many syntactic manifestations of unaccusativity.

[2] I assume a semantically inert verbalizer head $v_{\sim}$ in unaccusatives, following Marantz (1997) and Legate (2002). See Deal (2006) for discussion.

[3] The asymmetric view predicts that <e<st>> roots, in virtue of introducing a theme argument, should underlie transitives as well as unaccusatives. This helps us understand why transitive-unaccusative alternations are more common and productive than transitive-unergative alternations: the former alternation type involves only a single root which may or may not combine with v_{AG}, whereas the latter would involve a <e<st>> root in the transitive and an <st> root in the unergative.

roots introduce their argument without relying on functional structure, and so are of type <e<st>> (functions from individuals to properties of events). Unergative verbs use a functional head, v_{AG}, to introduce their argument; accordingly, unergative roots are of a lower type, <st> (properties of events).

The asymmetric view will require us to store in the lexicon a difference in semantic type between unergative and unaccusative roots. Additionally, we will have to ensure that unergative roots combine with v_{AG} and so receive an argument. This compositional requirement on unergatives could be syntactically driven if, for instance, an argument must be introduced to receive Case from T^0. Alternatively, it could be morphologically driven, if we state our vocabulary insertion rule for an unergative verb like *laugh* in terms of both the root and its associated v_{AG} head:

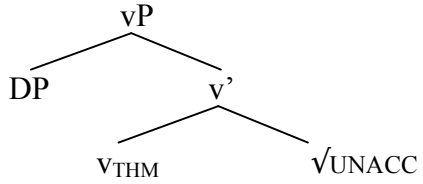
(4) Potential spell-out rules for unergatives[4]

$v_{AG} + \sqrt{LAUGH} > /læf/$ or $\sqrt{LAUGH} > /læf/ / v_{AG}$ __

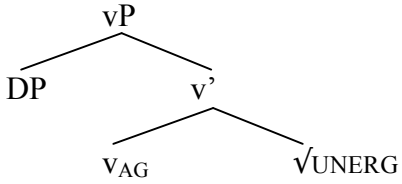
This spell-out rule ensures that $\sqrt{LAUGH}$ is only allowed to surface if it joins with an argument introducer, v_{AG}.

The second view I will be considering is a symmetric one: neither unergatives nor unaccusatives introduce an argument (Jelinek 1998, Borer 2004, i.a.).[5] Argument introduction is entirely factored out into functional structure. The two types of predicates differ only in the content of the v head they combine with; unaccusatives join with v_{THM} and unergatives join with v_{AG}. The two types of VPs then differ as follows:

(5) Unaccusative



(6) Unergative



(7) a. v_{AG} $\lambda x \lambda e$. Agent(x)(e)

b. v_{THM} $\lambda x \lambda e$. Theme(x)(e)

Such a view takes all verb roots to be essentially intransitive. Both unergative and unaccusative predicates are of type <st>: properties of events. Syntactic structure is responsible for all argument association in a neo-Davidsonian way (Dowty 1989). This syntactic structure must be responsible for all differences between unaccusatives and unergatives, as the verb roots themselves cannot distinguish the two classes.

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[4] Such rules provide for spell-out of syntactic structure in the framework of Distributed Morphology; see Halle and Marantz (1993), Harley and Noyer (1999).

[5] An alternative symmetric view would be that *both* types of intransitives introduce their own argument; this is similar to the lexical-semantics-only view discussed in fn. 1. While it might indeed be possible to elaborate a theory of unaccusativity which endowed verb roots with all necessary syntactic and semantic properties, such a view would necessarily be inconsistent with results showing a severing of external arguments from verb roots; see Kratzer 1996.

The symmetric view is a morphosemantic one in that the semantic differences between the two types of intransitives are reflected only in their morphological makeup. Unaccusative predicates contain v_{THM}; unergatives contain v_{AG}. We can require this via morphological rules:

(8) a. v_{THM} + √APPEAR > /əpiər/ or √APPEAR > /əpiər/ / v_{THM} __
b. v_{AG} + √LAUGH > /læf/ or √LAUGH > /læf/ / v_{AG} __

Such a view presents argument structure as a domain entirely beyond the purview of verb roots themselves: all argument association, be it for agent or for theme, is done by functional projections.

2. The theme argument and causativization

It has long been noted that unaccusatives but not unergatives participate in the causative alternation. Thus, unaccusatives *open* and *break* can causativize, but unergatives *cry* and *laugh* cannot:

(9) a. The door opened/broke.
b. The mother opened/broke the door.

(10)a. The baby cried/laughed.
b. *The mother cried/laughed the baby.

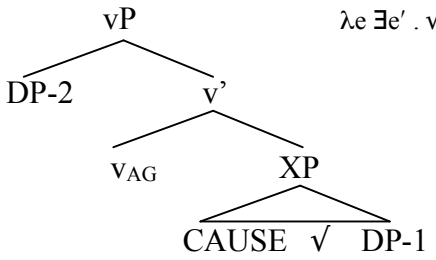
How can this difference in causativization bear on the choice between the symmetric and the asymmetric views of unaccusativity?

Recent work on causative structures has proposed a CAUSE head which introduces a bi-eventive structure, not an argument (Pylkkänen 2002, Kratzer 2005). This head enters into a structure with the root and the theme argument (remaining agnostic for a moment about how that combination is done), forming a structure which is then combined with the v_{AG} head which introduces the agent of the causative.[6]

[6] See Pylkkänen (2002) and Harley (2007) for evidence that CAUSE must be separated from the agent-introducing head.

(11)a. TR(CAUSE) = λP λe ∃e′ . P(e′) & CAUSE(e′)(e)[7]

b.

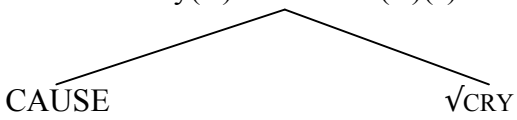


λe ∃e′ . √(e′) & THM(DP-1)(e′) & CAUSE(e′)(e) & AGT(DP-2)(e)

λe ∃e′ . √(e′) & THM(DP-1)(e′) & CAUSE(e′)(e)

Semantic rules of composition do not in themselves rule out the application of the CAUSE morpheme to an unergative vP or verb root. We must look to other areas of grammar to rule out structures like (12), well formed by function application (Heim and Kratzer 1998).

(12) * λe ∃e′ . cry(e′) & CAUSE(e′)(e)

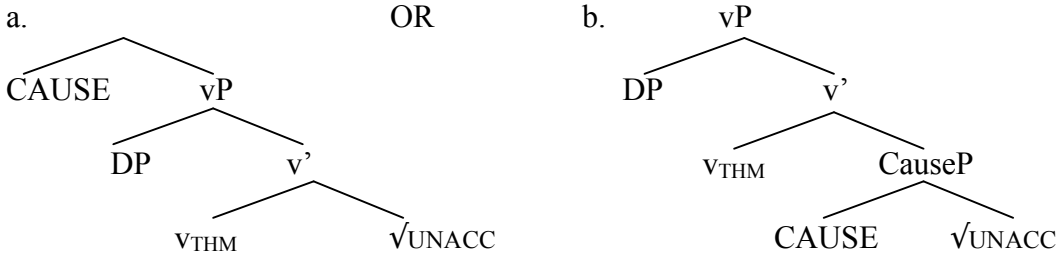


λP λe ∃e′ . P(e′) & CAUSE(e′)(e) λe. cry(e)

Both symmetric and asymmetric approaches to unaccusativity face the problem schematized in (12): semantic factors alone are not enough to rule out the causativization of unergatives (i.e. the application of a direct causation head CAUSE to an unergative root). The two approaches will, however, have to state the prohibition on causativized unergatives in different ways. On the symmetric approach, the fact that unaccusatives can be causativized means that either unaccusative vPs can be embedded under CAUSE, (13a), or unaccusative roots can be embedded under CAUSE, (13b). (Only one of these structures need be grammatical.) The fact that unergatives cannot be causativized means that *neither* the unergative *v*P complete with argument, (14a), nor the unergative root itself, (14b), can be embedded under CAUSE.

(13) Unaccusative

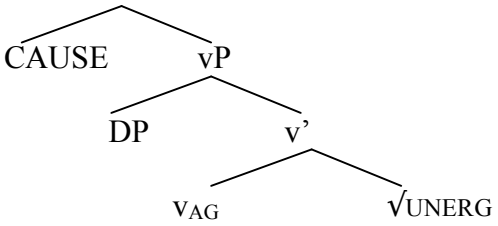
a. OR b.



[7] Crucially, the CAUSE relation here introduces DIRECT CAUSATION. See Kratzer (2005) for discussion of direct versus indirect causation, and an argument that the abstract CAUSE head introduces only the former.

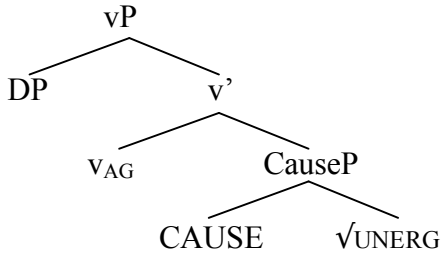
(14) *Unergative[8]

a.



NOR

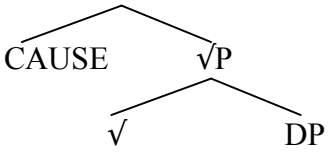
b.



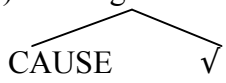
Because the symmetric view does not syntactically distinguish between unergative and unaccusative roots, it is unlikely that (13b) would be taken as the grammatical representation of causativized unaccusatives, given the ungrammaticality of (14b). We can state a blanket prohibition on CAUSE that bars it from combining with bare roots, ruling out both (13b) and (14b). If (13a) is then the representation of a causativized unaccusative, we must only allow CAUSE to combine with an unaccusative vP, not an unergative one, in order to rule out (14a).

On the asymmetric view, on the other hand, we can categorically rule out vP under CAUSE in virtue of syntactic selection or morphological mismatch. While CAUSE can embed projections of roots, we must stipulate that it cannot embed bare roots.[9]

(15) Unaccusative



(16) *Unergative



While function application could still apply if CAUSE were applied to an unergative verb root (type <st>), as in (16), it may be that we can only apply CAUSE to events that are in some way complete, including their argument.

The argument-completeness requirement is supported by the cross-linguistic generalization that "change of state" verbs can only be formed out of saturated <et> predicates: unaccusative verbs, comparative and non-gradable adjectives, and nouns, but not unergative verbs or adverbs (Bobaljik 2006). Such a division makes sense in light of the asymmetric view: unaccusatives, adjectives and nouns are all <e<st>> roots, subject to saturation by a single entity-type argument and thus to insertion in structure (15). It does not follow from the symmetric view quite so neatly, however: we must allow

[8] Note that the v_{AG} head in these examples will end up lower than the v_{AG} head introduced above XP in (11b). The v_{AG} head shown in (14a) does not introduce the agent of the causing event; it introduces the agent of the *caused* event.

[9] This finding is at odds with the predictions of Bare Phrase Structure (Chomsky 1995), which treats all maximal projections identically regardless of whether they branch. In a Bare Phrase Structure model, a category X which does not project beyond its head is treated equivalently to an XP containing internal structure; heads which do not project are simultaneously minimal and maximal projections. Thus, it is odd that a √P should be permitted where a non-projecting √ is blocked. This issue merits further research.

CAUSE to embed nP, aP and unaccusative vP, but not unergative vP or adverbial advP. Since all roots are stripped down to type <st>, we lose the properties that makes this distinction a non-arbitrary one. We must simply stipulate what CAUSE can and cannot embed, without recourse to a systematic difference in the syntax and semantics of its possible and impossible complements.

This discussion of causatives is only informative, however, insofar as we can be sure that the CAUSE head productively combines with roots to build causative verbs. If all causative verbs are stored in the lexicon as such, the restriction on causativized unergatives may not be a grammatically informative one. Psycholinguistic results are helpful in this respect, in that they provide evidence that the processor is aware of the unergative/unaccusative distinction in generating causative structures on-line.

A study by Kako (2006) addressed this question by asking participants to evaluate ungrammatical sentences on a variety of measures related to verb meaning and argument roles. Participants were presented with sentences containing unergative or non-alternating unaccusative verbs used transitively. All such sentences were ungrammatical, and all their arguments were supplied by uninformative nonce nouns. (17) exemplifies.

(17) How likely is it that *arriving* in *The zum arrived the dax* involved someone or something…
1. being created?
2. causing someone or something else to do something?
3. changing physically?
4. exerting force on someone or something else?
5. making physical contact with someone or something else?

Given the fact that a stored transitive meaning is not available for the verb, how is the transitive structure to be interpreted?

The results of this study show a difference between unergatives and unaccusatives on two measures related to causative interpretations: CHANGING PHYSICALLY and EXERTING FORCE. These two factors were ascribed significantly more often to subjects and objects of transitivized unaccusatives than to subjects and objects of transitived unergatives (CHANGING PHYSICALLY, $p<.01$; EXERTING FORCE, $p<.05$). This implies that unaccusatives underwent a sort of causative alternation that unergatives did not have available to them. The result suggests that the processor is aware of the fact that only unaccusatives go in causative structures, and uses this fact to construct causative frames for unaccusatives more often than for unergatives.

3. The interpretation of coerced intransitives: new results

If the asymmetric view is the correct one, speakers are aware that unaccusative roots and unergative roots are of different types. They use this information on-line to build causative structures for unaccusatives, but not for unergatives. To see this structural

knowledge in action, we must look at verbs that are not already grammatically transitive; otherwise we might be looking at lexicalized (i.e. memorized) differences. But in doing so we run up against a number of important questions about the interpretation of ungrammatical sentences. What can we assume about how the processor treats these cases?

In this section, I will develop an explicit theory of the interpretation of transitivized intransitives that rests on a theory of FUNCTIONAL COERCION. In light of this framework, novel data will be presented to show that unaccusatives are susceptible to causativization in a way that unergatives are not.

3.1 Coercion

We must first ask why it is that transitivized intransitives like *The zum arrived the dax* are ungrammatical. We know from diagnostics of inchoativity, such as the interpretation of *by itself*, that the root √ARRIVE is prohibited from combining with CAUSE. As originally noted by Chierchia (1989) for Italian, *by itself* has a reading in certain unaccusatives that we can paraphrase as 'without outside help'. The presence of this reading is a diagnostic of the presence of a CAUSE head. (Inchoative √FALL, which combines with CAUSE routinely, in shown for contrast in (19).)

(18) The plane arrived early by itself
- ✓ Nothing else arrived early. ('alone' reading)
- * Nothing caused the early arrival. ('without outside help' reading)

(19) The vase fell off the shelf by itself.
- ✓ Nothing else fell off the shelf. ('alone' reading)
- ✓ Nothing caused the vase to fall. ('without outside help' reading)

Given that other "pure unaccusative" roots like *hang* and *hide* can nevertheless allow a transitive causative structure, it seems to be a fact of morphological combination, not semantic well-formedness, that √ARRIVE and its kin (e.g. √APPEAR, √LIVE) cannot enter into transitive causative structures. Similar morphological prohibitions account for the inability of inchoative roots like √FALL and √BLOOM to transitivize by combination with v_{AG}, even though such verbs presumably contain CAUSE routinely (Alexiadou et al. 2005, Deal 2006).[10] When these morphological restrictions are ignored, ungrammaticality results.

The term coercion is generally used to refer to cases where a root is inserted into functional structure it is not typically paired with, but where no morphological restrictions are violated. Examples of such grammatical coercion include the use of proper names as property-type NPs, not referential DPs:

[10] The fact that such restrictions follow from potentially rather arbitrary morphological sources shines through in the fact that children often ungrammatically transitivize intransitives, e.g. *fall*, *disappear* (MacWhinney 2004).

(20) *Property-coerced names*
a. This is not the Paris I know.
b. There is a Santa Claus.

Here, I extend the term refer to cases where a root is inserted into structure it is semantically but not morphologically compatible with, as in the examples of transitivized intransitives just discussed. These cases are not typically considered coercion, because they are ungrammatical. However, they exhibit the same atypical pairing of root and functional structure as the grammatical cases.

The inclusion of transitivized intransitives in the family of coercion effects allows us to draw on two important results about coercion/type-shifting from the cross-linguistic literature. First is the property of "type-range preservation" (Bittner & Hale 1996): coercion/type-shifting cannot yield an item which pairs syntactic categories and semantic types in a way which is not otherwise attested in the language. This suggests that interpretations produced through coercion are constrained to make use of independently justified resources. Coercion does not make use of specialized means in producing meanings; it simply uses the structures and rules the language has generally made available.[11] A second result supports this view: coercion/type-shifting cannot be covert if there is an overt morpheme with the same effect (Chierchia 1998: 360). This effect follows straightforwardly if structures built by coercion use the same materials as structures built independently of coercion. If a head can be spelled out in a language, it will be, regardless of whether it was introduced by coercion or otherwise.

It is in the spirit of these results, as well as the strong compositionality hypothesis, that I take coercion (and type-shifting) to be represented in the syntax, in the sense of the functional structure surrounding the root. Ungrammatical sentences like *The zum arrived the dax* can only be interpreted by the normal means of interpretation, once their morphological problems are set aside. We must grant that the root of the transitivized intransitive (√ARRIVE) will not be morphologically compatible with CAUSE; this problem will arise for both unergatives and non-alternating unaccusatives. Beyond this, though, if the two types of roots are themselves different, we might expect unergative roots to resist causativization where unaccusative roots allow it. If the roots are not different, though, similar morphological but not semantic problems should appear in both types of transitivization, without a preference for causative interpretations by one type of verb or the other.

3.2 Methods

3.2.1 Materials

This experiment was conducted as a questionnaire survey consisting of 28 items. Each item consisted of a definite subject nonce noun, a verb and potentially a preposition, and

[11] We should therefore expect that the violation of a certain morphological rule, such as the prohibition on transitive *cry*, should not lead the parser to throw out other morphological rules to produce an interpretation. We should still expect whatever principles rule out causativized unergative roots to remain in effect.

a definite object nonce noun. All nonce nouns were CVC or CVCC and conformed to English phonotactics. (21) exemplifies.

(21) THE ZAG WILL VACATION THE NUK
How natural is this sentence? very natural 1 2 3 4 not very natural
Paraphrase the meaning of this sentence.

Study participants were instructed to rate each sentence on how natural it sounds in terms of English grammar, and to write a paraphrase. Of the 28 items, 12 were experimental (ungrammatical) and 16 were fillers (grammatical).

Test verbs were sorted into unaccusative, inchoative and unergative categories by diagnostics of *there*-insertion (Deal 2006), prenominal modifier formation, the interpretation of 'by itself', and resultative formation with an "fake reflexive" object (e.g. *She laughed herself sick*; Levin and Rappaport-Hovav 1995). While both the 'unaccusative' and the 'inchoative' classes are considered unaccusatives, the further differentiation here allows us to control for the fact that inchoatives combine with a CAUSE head as a matter of course, whereas "pure" unaccusatives do not.

Figure 1. Verb class diagnostics

	unaccusative e.g. *arrive*	inchoative e.g. *fall*	unergative e.g. *laugh*
there-insertion possible	Y	N	N
prenominal modifier formation possible	Y	Y	N
'by itself' has a causation reading	N	Y	N
resultative is formed with fake reflexive	N	N	Y

Filler verbs were likewise varied, containing both causative and non-causative transitives, aspectual verbs and verbs with prepositional objects corresponding to a variety of thematic roles. A complete list of test verbs and filler verbs is given in the appendix.

The questionnaire was administered in two forms. Test items and fillers were the same, but the order of test items was pseudo-reversed. 25 participants used the first form; 16 used the second.

3.2.2 Subjects

41 monolingual native speakers of English participated in this experiment in exchange for extra credit in an introductory undergraduate linguistics class.

3.2.3 Analysis and results

Data was first scored for grammaticality responses, and data from 5 participants was discarded because their average ratings for grammatical sentences was higher (i.e. worse)

than their ratings for ungrammatical sentences. These subjects had all used the 1st form. A single factor ANOVA conducted on the remaining 36 data points revealed no significant effect of verb type on grammaticality rating ($p>0.3$).

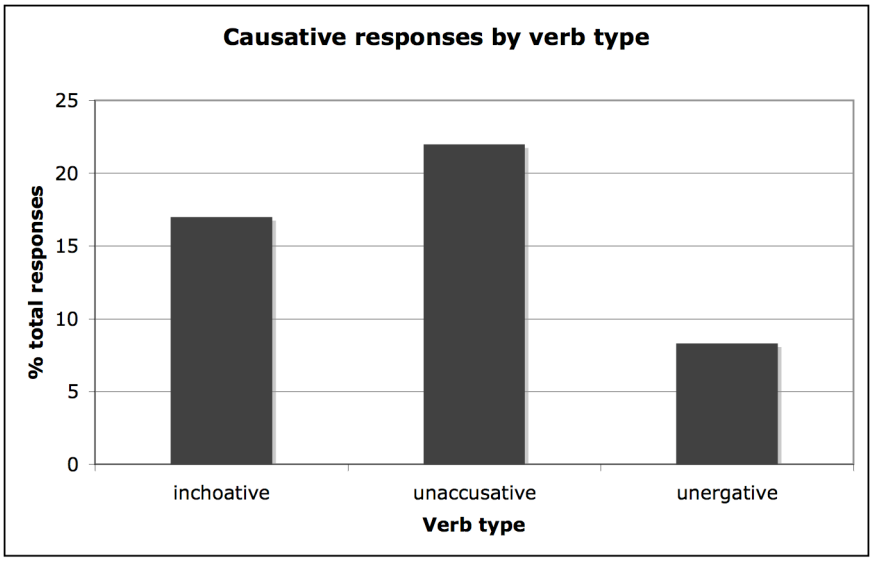
Data from the 36 remaining subjects was examined and classified by paraphrase type. Paraphrases were semantically quite various. The classificatory rubric coded the following categories:

Figure 2. Paraphrase coding categories

1. CAUS	Uses *cause*, *make*, causative light verb (e.g. the X sent the Y on vacation), from-PP (e.g. the X bloomed from the Y), or 'because of' (e.g. the X bloomed because of the Y)
2. PP	Object is paraphrased as a prepositional phrase, or sentence is passivized with a preposition
3. LOC	Object is paraphrased as *somewhere* or *the place*, but no preposition is used
4. TRANS	Transitive but not causative, or passive but not causative
5. COG OBJ	Object is taken to denote a cognate object of the verb (e.g. the X lived the good life, the x laughed a kind of laugh)
6. XCOMP	Obj is taken as a predicate complement (e.g. the X will appear the best)
7. RESULT	Resultative paraphrase; verb is taken as unergative (e.g. the X was fidgeting causing the Y to fall)
8. -	Paraphrase uses unrelated verb

Setting aside the uninformative TRANS and – types, the most common paraphrase types were CAUS, LOC and PP. Figure 3 shows the percent of total responses across all subjects devoted to causative paraphrases as a factor of verb type.

Figure 3.



Subjects' responses were sorted by verb class and a total number of causative responses per class was tabulated, yielding a number between 0 (no causative responses in category) and 4 (all causative responses in category) for each subject and verb class. A single factor ANOVA on this data set revealed a significant effect of verb class on frequency of causative paraphrase ($p=0.03$). 2-tailed t-tests comparing unaccusative and unergative classes yielded a significant effect ($p=0.0003$), as did the comparison of inchoative and unergative classes ($p=0.017$). No significant difference was found between unaccusative and inchoative classes ($p>0.3$).

Results by verb are given in Figure 4. In addition to causative paraphrase counts, locative and prepositional paraphrase counts are given as a reference point.

Figure 4. Causative paraphrases by verb

unerg	*inch*	*unacc*	causatives	locative/pp
		appear	11	13
		arrive	10	20
	fall		9	15
		drift	8	15
	bloom		8	2
vacation			7	17
	soar		6	18
laugh			4	22
		live	3	17
	surge		2	2
fidget			1	14
crawl			0	27

Verb-by-verb comparison shows unaccusatives *appear* and *arrive* to be the most frequently causativized; unergative *crawl* comes in last without a single causative paraphrase assigned.

3.2.4 Discussion

The findings from this study reinforce Kako's (2006) finding that unaccusatives are more likely to become causative when transitivized than unergatives are. This difference by verb class is explained on the asymmetric approach to unaccusativity, which predicts that unaccusative roots can be used in causative structures but unergative roots cannot. Causativizing an unergative verb involves something totally different than causativizing an unaccusative verb (or an inchoative one): the parser must come up with a whole new root. This costly consequence disfavors the causativization of unergative roots only.

(22) Asymmetric view of the derivation of causative readings
- unaccusative root is used
- unaccusative morphological restriction is violated
- unergative root is <u>not</u> used
- unergative morphological restriction is violated

On the symmetric view, by contrast, unergative roots and unaccusative roots would be morphosemantically the same: neither introduces an argument, and neither is morphologically well-formed without its associated v head. On this view, causativizing an unergative is just more coercion: putting a root in functional structure it is not morphologically compatible with. If increased violation of morphological requirements is responsible for the dispreference for causativized unergatives, we might expect to find a cline of preferences for causativization, with inchoatives most causativization-prone and unergatives least:[12]

(23) Symmetric view of the derivation of causative readings
- inchoative morphological restriction is violated by introduction of v_{AG}.
- unaccusative morphological restriction is violated by introduction of CAUSE and v_{AG} above that.
- unergative morphological restriction is violated by introduction of v_{THM}, CAUSE, and v_{AG} in that order.

This predicted cline fails to appear in the experimental results. Rather than a three-way split between the verb classes with inchoatives most causative-friendly, then unaccusatives, then unergatives, we find inchoatives and unaccusatives behaving categorically distinct from unergatives. This finding problematizes the claim that only coercion in the sense of morphological mismatch is relevant to causativized intransitives. Rather, it appears that the behavior of a verb class under causativization is sensitive to the type of root used by that class. This necessitates that verb classes differ in root type, *contra* the symmetric approach.

Given these considerations, results from this experiment provide new support for the asymmetric approach to unaccusativity. We can explain the preferences regarding causativized intransitives in terms of behavior of the root itself, but not in terms of differences between functional heads. There seems to be a cost associated with turning unergative roots into unaccusative roots. This in turn requires that unergative roots be represented differently than unaccusative ones, necessitating an asymmetric approach to argument structure.

4. Conclusion

The results discussed here suggest an important limit on the structural decomposition of verb meanings: whatever else might be factored out into functional structure, theme argument-taking must remain a property of roots themselves. This view is an asymmetric one in that it allows only themes, and not other types of arguments, to be introduced by the root. We have seen evidence for just such a distinction between theme and agent arguments in the realm of unaccusativity, where results from causativization provide evidence for a distinction between unergative verb roots and unaccusative ones. In a transitivized structure, unaccusative roots can be used to build causative vPs, explaining

[12] Recall that inchoatives are unaccusatives which morphologically require CAUSE.

why causative paraphrases are common ones for transitivized unaccusatives. Unergative roots are semantically incompatible with the CAUSE head that builds causatives; experimental subjects are therefore less willing to interpret transitivized unergatives as causatives than transitivized unaccusatives.

Methodologically, we have seen evidence that the theory of coercion introduced here is psychologically predictive as well as typologically informed. Given an explicit theory of how certain ungrammatical structures are processed, paraphrase-type tasks such as the one discussed above have potential in uncovering aspects of grammatical generalization which are typically obscured by morphological filtering. Sentences that are ungrammatical due only to a violation of morphological co-occurrence restrictions can and must be interpreted with independently existing means. Coercion is merely composition. Insofar as we understand the combinatorial mechanics of interpretation, then, studies of coercion can reveal to us certain properties of what it is that is being combined.

The coercion-based method applied to on-line causativization allows a glimpse of what the processor can access when it accesses the verb root. In this way, psycholinguistic results provide an important source of empirical evidence for deciding between grammatical theories, particularly those concerning such elusive entities as underspecified roots. The data here provide new evidence for the psychological reality of such roots qua grammatical formatives accessed in comprehension, whose properties include the barest minimum of argument structure: the presence or absence of a single argument.

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Appendix: experimental verbs

Test items

UNACCUSATIVE	INCHOATIVE	UNERGATIVE
appear	fall	laugh
arrive	soar	fidget
drift	surge	vacation
live	bloom	crawl

Filler items

TRANSITIVE	PREPOSITIONAL		ASPECTUAL
kiss	revolve around	*loc*	begin
meet	look at	*goal*	start
see	danced for	*ben*	complete
open	come from	*source*	finish
destroy	fight with	*inst/assoc*	
break	help with	*goal*	

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