Comparative-induced event measure relations

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In Vietnamese quantity comparison structures, differentials are prohibited from appearing phrase-internally. I argue this is because they are athematic measure phrases. However, this leads to a semantic type clash given the meaning of the comparative. I propose to resolve this by means of a COMPARATIVE-INDUCED EVENT MEASURE RELATION which type-shifts the predicate in the appropriate context. This relation is also shown to be active in English, suggesting that it may be a more general property of predicates cross-linguistically.

1 Comparison in Vietnamese

In simple statements, both "adjectival" (stative) and "verbal" (dynamic) predicates appear to take the same types of arguments:

(1) a. Lửa cao mười/nhiều mét.
      fire tall ten/many   meters
      'The fire is ten/many meters high.'

   b. Ngọc đọc mười/nhiều cuốn sách.
      Ngọc read ten/many   CLF book
      'Ngọc reads ten/many books.'

In comparative structures, differentials canonically occur phrase-finally:

(2) a. Ngọc cao hơn Phượng 10/nhiều cm.
      Ngọc tall HƠN Dũng   10/many cm
      'Ngọc is ten/many cm taller than Phượng.'

   b. Ngọc đọc hơn Phượng sáu/nhiều cuốn sách.
      Ngọc read HƠN Phượng six/many CLF book
      'Ngọc reads six/many more books than Phượng.'

Phrases involving *nhiều* 'many' are also acceptable when the magnitude of the difference between the amounts is very small (probably because it is actually a pure existential which can be strengthend).

However, in quantity comparison structures, phrases with *nhiều* 'many' may directly follow the predicate, while Num+ClP phrases may not.

(3) a. Ngọc đọc nhiều (cuốn) sách hơn Phượng.
      Ngọc read many CLF   book HƠN Phượng
      'Ngọc reads more books than Phượng.'

   b. *Ngọc đọc sau cuốn sách hơn Phượng.
   Ngọc read six CLF book HƠN Phượng

Puzzle: if *nhiều* 'many' is a determiner, then the unacceptability of (3b) is expected, but this present a type clash in the interpretation of (2b).

Proposal: when following the predicate, *nhiều* is a parameterized determiner argument; phrase-final ClPs are athematic measure phrase adjuncts to *gradable* stative predicate meanings, which are derived from *quantizable* eventive predicate meanings.

2 Semantics of comparison

Assuming a relational analysis of phrasal comparatives, where gradable predicates containing a degree argument DegP, denoting relations of type <d,<e,t>> between individuals and degrees (Creswell 1976; von Stechow 1984; Heim 1985, 2000)
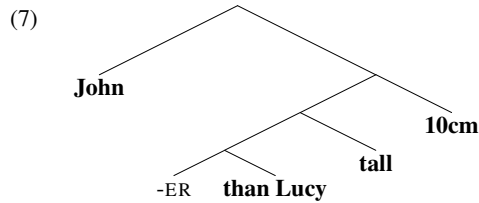
(4) a. Ann is 10cm taller than Lucy.   b.

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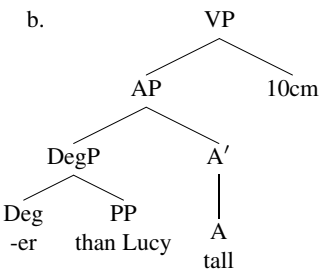
While the meaning of the comparative is often assumed to be something like (5a), this must be expanded to account for differentials (5b). The first can always be derived from the second by existentially binding the degree argument.

(5)   a. $[\![\text{-ER}]\!] = \lambda y \lambda f_{<d,et>} \lambda x.max(f)(x) \succeq max(f)(y)$

   b. $[\![\text{-ER}]\!] = \lambda y \lambda f \lambda d \lambda x.max(f)(x) - max(f)(y) \geq d$

(6)   John is 10cm taller than Lucy.

(7)

$= [\![\text{-ER}]\!]([\![\textbf{Lucy}]\!]) = [\lambda y \lambda f \lambda d \lambda x.max(f)(x) - max(f)(y) \geq d](\text{Lucy})$
$= \lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Lucy}) \geq d$

$= [\![\text{-ER } \textbf{than Lucy}]\!]([\![\textbf{tall}]\!])$
$= [\lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Lucy}) \geq d]([\lambda d \lambda x.\textbf{tall}](x) \geq d)$
$= \lambda d \lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Lucy}) \geq d$

$= [\![\textbf{taller than Lucy}]\!]([\![\textbf{10cm}]\!])$
$= [\lambda d \lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Lucy}) \geq d](\text{10cm})$
$= \lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Lucy}) \geq \text{10cm}$

The same comparative meaning can be used to compute the denotations for structures containing dynamic predicates as well as those containing **many**, a (type-shifted) parameterized determiner (Hackl 2000)

(8) $[\![\textbf{many}]\!] = \lambda d \lambda f_{<e,t>} \lambda g_{<e,<e,t>>} \lambda y.\exists x[f(x) \wedge g(x)(y) \wedge |x| = d]$

(9)   John buys more books than Mary.

(10)
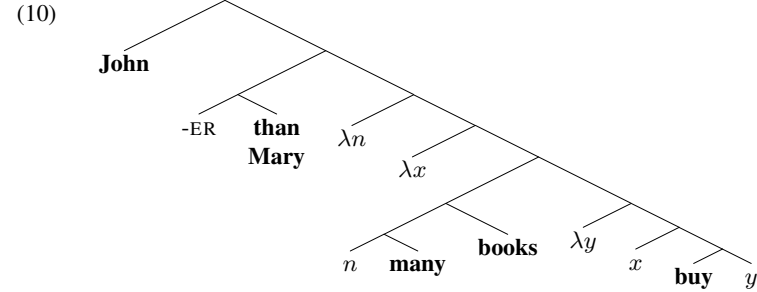
$= [\![\textbf{buy n many books}]\!] = \lambda n \lambda y.\exists x[book(x) \wedge |x| = n \wedge buy(y)(x)]$
$= [\![\textbf{buy more books than Mary}]\!] = \lambda y \exists x[book(x) \wedge |x| = n$
$\wedge max\{buy(y)(x)\} \succeq max\{buy(Mary)(x)\}]$

(*more* is just the morphological spell-out of $[\![\textbf{many}]\!]$ + $[\![\text{-ER}]\!]$.)

2.1   Vietnamese

For stative comparison, we can apply these same denotations to Vietnamese. Once again, the comparative combines with a degree relation:

(11) $[\![\textbf{hơn}]\!] = \lambda y \lambda f \lambda d \lambda x.max(f)(x) - max(f)(y) \geq d$

(12)   Linh cao hơn Phượng 10cm.
   Linh tall hơn Phượng 10cm
       'Linh is 10cm taller than Phượng.'

(13)

$= [\![\textbf{hơn}]\!]([\![\textbf{Phượng}]\!]) = [\lambda y \lambda f \lambda d \lambda x.max(f)(x) - max(f)(y) \geq d](\text{Phượng})$
$= \lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Phượng}) \geq d$

$= [\![\textbf{hơn Phượng}]\!]([\![\textbf{cao}]\!])$
$= [\lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Phượng}) \geq d]([\lambda d \lambda x.\textbf{tall}](x) \geq d)$
$= \lambda d \lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Phượng}) \geq d$

$= [\![\textbf{cao hơn Phượng}]\!]([\![\textbf{10cm}]\!])$

$= [\lambda d\lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Phượng}) \geq d](10cm)$

$= \lambda x.max(\textbf{tall})(x) - max(\textbf{tall})(\text{Phượng}) \geq 10cm$

(14) $[\![\textbf{nhiều}]\!] = \lambda d\lambda f_{<e,t>}\lambda g_{<e,<e,t>}\lambda y.\exists x[f(x) \wedge g(x)(y) \wedge |x| = d]$

(15) Linh mua nhiều sách hơn Phượng.
Linh buy many book hơn Phượng
'Linh bought more books than Phượng.'

(16)
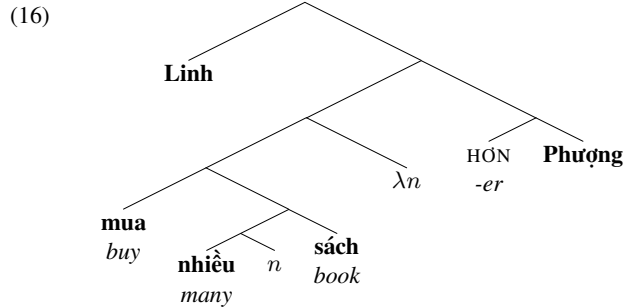
$= [\![\textbf{mua n nhiều sách}]\!] = \lambda n\lambda y.\exists x[book(x) \wedge |x| = n \wedge buy(y)(x)]$

$= [\![\textbf{Linh mua nhiều sách hơn Phượng}]\!] = \exists x[book(x) \wedge |x| = n$
$\wedge max\{buy(Linh)(x)\} \succeq max\{buy(Phượng)(x)\}]$

2.1.1 Phrase-final structures

Now: what makes these structures different from what we have just seen?

(17) Linh mua hơn Phượng sau/nhiều cuốn sách.
Linh buy HƠN Phượng six/many CLF book
'Linh bought six/many more books than Phượng.'

Three issues:

1. the comparative operator appears to be combining directly with the verb;

2. there appears to be a differential interpretation of the NP containing *sách* 'book';

3. both Num+ClP and *nhiều* 'many' can appear phrase-finally.

Can we be certain that the comparative is combining directly with the predicate? I.e., is it possible that (17) contains elided structure? Unlikely:

(18) a. ??Linh mua nhiều sách hơn Phượng sau cuốn sách.
Linh buy many book hơn Phượng six CLF book

b. Linh mua hơn Phượng sau cuốn sách.
Linh buy hơn Phượng six CLF book

If (18a) was derived from (18b), why the contrast in acceptability?

Secondly, can we show that the phrase-final elements are being interpreted as differentials? Without the classifier, (17) is deprecated (as is (15) *with* a classifier in certain circumstances). Schwarzschild (2004) argues that because degree arguments are 'functional' (athematic), measure phrases (MPs) must be adjuncts, not syntactic arguments of the adjective.

"...the ungrammaticality of *my father's height tall* is expected because although *tall* has a degree argument, that argument is non-thematic." (2)

Is there language-internal evidence that Vietnamese MPs are athematic?

2.1.2 Được

One context in which phrase-final differential and *nhiều*-phrases behave 'athematically' is with *được*, a passive/benefactive marker (Duffield 2001):

(19) a. Martha cho James một cuốn sách.
Martha give James one CLF book
'Martha gave James a book.'

b. James được Martha cho một cuốn sách.
James ĐƯỢC Martha give one CLF book
'James was given a book by Martha.'
('James was the benefactor of Martha's book-buying.')

(20) shows that *nhiều sách* 'many books' can be given this benefactive reading, but *nhiều sách hơn Le* 'more books than Le' cannot:

(20) a. Việt mua nhiều sách hơn Le.
Việt buy many book HƠN Le
'Viet bought more books than Le.'

b. Nhiều sách được Việt mua hơn Le.
many book ĐƯỢC Việt buy HƠN Le
'More books than Le (bought) were bought by Viet.'

c. *Nhiều sách hơn Le được Việt mua.
many book HƠN Le ĐƯỢC Việt buy

In structures with phrase-final differentials or *nhiều*-phrases, transformations involving *được* are robustly ungrammatical, suggesting that the phrase-final elements are athematic.

(21) a. Việt mua hơn Le nhiều cuốn sách.
Việt buy HƠN Le many CLF book

'Viet bought many more books than Le.'

b. *Nhiều cuốn sách được Việt mua hơn Le.
many CLF book ĐƯỢC Việt buy HƠN Le

c. *Nhiều cuốn sách hơn Le được Việt mua.
many CLF book HƠN Le ĐƯỢC Việt buy

(22) a. Việt mua hơn Le ba cuốn sách.
Việt buy HƠN Le three CLF book

'Viet bought 3 more books than Le.'

b. *Ba cuốn sách được Việt mua hơn Le.
3 CLF book ĐƯỢC Việt buy HƠN Le

c. *Ba cuốn sách hơn Le được Việt mua.
3 CLF book HƠN Le ĐƯỢC Việt buy

2.1.3 Phrase-final structures, part 2

If phrase-final objects are adjuncts, this presents a problem for the analysis of **hơn**:
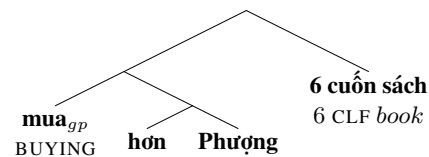
(23)
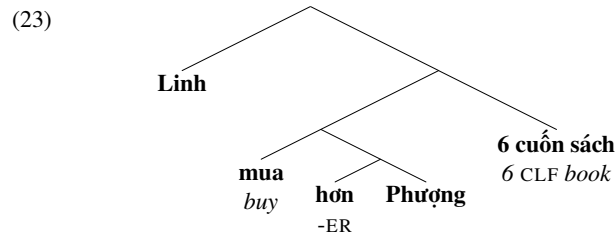
Problem: $⟦\textbf{mua}⟧$ is the wrong kind of argument to $⟦\textbf{hơn Phượng}⟧$ given (11) because $⟦\textbf{hơn}⟧$ has an argument that can only be saturated by a gradable predicate.

Solution(s): either two $⟦\textbf{hơn}⟧$s, or two $⟦\textbf{mua}⟧$s.

In the absence of any additional, independent evidence for two comparative operators, or constraints on the distribution thereof, let's consider the second option. A gradable meaning of **mua** (call it $⟦\textbf{mua}_{gp}⟧$) encodes a measure function that takes an object x and provides a measure of how much buying x did.

(24) a. $⟦\textbf{cao}⟧ = \lambda d \lambda x.\textbf{tall}(x) \geq d$
b. $⟦\textbf{mua}_{gp}⟧ = \lambda d \lambda x.\text{BUYING}(x) \geq d$

(25)

$= ⟦\textbf{hơn}⟧(⟦\textbf{Phượng}⟧) = [\lambda y \lambda f \lambda d \lambda x.max(f)(x) - max(f)(y) \geq d](\text{Phượng})$
$= \lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Phượng}) \geq d$

$= ⟦\textbf{hơn Phượng}⟧(⟦\textbf{mua}⟧) = [\lambda f \lambda d \lambda x.max(f)(x) - max(f)(\text{Phượng}) \geq d]([\lambda d \lambda x.\text{BUYING}](x) \geq d])$
$= \lambda d \lambda x.max(\text{BUYING})(x) - max(\text{BUYING})(\text{Phượng}) \geq d$

$= ⟦\textbf{mua hơn Phượng}⟧(⟦\textbf{6 cuốn sách}⟧) = [\lambda d \lambda x.max(\text{BUYING})(x) - max(\text{BUYING})(\text{Phượng}) \geq d](6 \text{ cuốn sách})$
$= \lambda x.max(\text{BUYING})(x) - max(\text{BUYING})(\text{Phượng}) \geq 6 \text{ cuốn sách}$

3 Comparative-induced event measure relations

Can (and should) gradable meanings for predicates like $\textbf{mua}_{gp}$ (BUYING) be derived from meanings like **mua** 'buy'?

• Verbs like *begin* and *enjoy* which select for complements that denote activities or events can force NP direct objects to type-shift (*John began (to read/reading) the book*)

• A related phenomenon: OBJECT-INDUCED EVENT MEASURE RELATIONS (Krifka 1990)

(26) 4000 ships passed through the lock last year.

(26) is true if (a) there exist 4000 distinct ships, each of which passed through the lock last year, or (b) the number of passing events which transpired in the past year sum to 4000. So *4000 ships* can either (a) refer to objects in the normal one-to-one fashion, or (b) denote a degree of a measure function.

Krifka proposes a polysemous null determiner μ having either interpretation in (27), where Q is a nominal property; R is a VP meaning (relation between a subject argument and event); u is a (non-atomic) entity; e is an event; and **OEMR** is a function from a VP to an *object-induced event measure relation* (28).

(27) a. Object-related zero determiner: $\lambda Q \lambda R \lambda e \lambda u[R(e, u) \wedge Q(u)]$
b. Event-related zero determiner: $\lambda Q \lambda R \lambda e[\textbf{OEMR}(R)(e, Q)]$

(28) OBJECT-INDUCED EVENT MEASURE RELATION: if R is a VP relation, **OEMR**(R) is a relation between an event e and a quantized measure Q which is

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guaranteed to hold if e can be decomposed into non-overlapping subevents whose measures add up to the measure specified by Q (Barker 1999:3).

Krifka constructs a measure function on events from the meaning of the verbal predicate alone. Can something similar be done for the Vietnamese comparative?

(29) **CEMR**: for every predicate P with a meaning of type <e,et>, there is a predicate P' with the following meaning of type <d,et>: $\lambda d \lambda x. P'(x) \geq d$
The relation CEMR applied to a non-gradable predicate P yields a gradable predicate P' that returns the degree to which x is P'.

So **CEMR(mua)** yields a predicate **mua′** which specifies the degree to which x has participated in a buying event; but what kind of measure is that?

What is needed: a scale along which the predicative action P' can be measured. The differential (derived from the meaning of the direct object of P) names the points.

- **cao** 'tall': points = 'heights'; GP denotes a relation between individuals and heights

- **mua**$_{gp}$: points are derived directly from the meaning of the differential

Assume a differential like **6 cuốn sách** '6 CLF book' generally has a meaning like that shown in (30) (modulo the complexities of the classifier meaning itself):

(30) $\exists x. book(x) \wedge |x| = 6$

This meaning may then be generalized to that of (31):

(31) $\exists x. f(x) \wedge |x| = n$

Given an ordered scale $\mathcal{S}$ with points $n_0, n_1 \ldots n_k \in \mathbb{Z}$, each point may be renamed (32):

(32) $\exists x. f(x) \wedge |x| = n_0, \exists x. f(x) \wedge |x| = n_1, \ldots \exists x. f(x) \wedge |x| = n_k$

These functions then name degrees analogous to *1 inch, 2 inches, 3 inches...*

The set from which the scale $\mathcal{S}$ comes is unimportant so long as it describes ordered points which may be put into one-to-one correspondence with predicates of the type given in (31).

Once this is accomplished, the transformed measure phrase can be used to measure the size of the gap between the degree to which two individuals possess some gradable quality, e.g. Linh's BUYING and Phượng's BUYING measured with respect to books for **mua**$_{gp}$.

4 *Out*-prefixation

A related phenomenon: *out*-prefixation in English

(33) a. John ate 4 pies.
      b. John out-ate Mary by 4 pies.

(34) a. I wrote 4 essays.
      b. I out-wrote Jim by 4 essays.

However, not all predicates are amenable to *out*- prefixation (35-36)...

(35) a. John recognized 4 people.
      b. *John out-recognized Mary (by 4 people).

(36) a. I completed 4 essays.
      b. *I out-completed Mary (by 4 essays).

...and among those that are, a differential is not always an option:

(37) a. Obama out-niced Clinton in the primary ??(by a dozen hugs).
      b. Kim out-danced me last night ??(by 4 minutes).
      c. The Giants out-played the Patriots *(by 3 games/4 throws).
      d. Justin out-sang Kelly *(by 3 songs/4 solos/6 points).

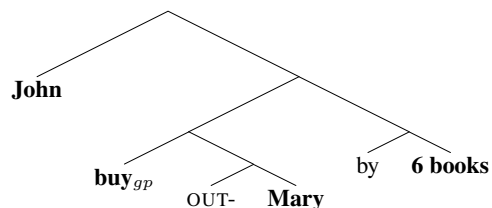Why? CEMR only applies to predicates which can receive quantized eventive readings.

(38) a. Obama really out-niced Clinton last night (in the course of some debate/conversation/series of events).
      b. Kim out-danced me last night (in the course of the evening/a song, she danced more/better than I did).
      c. The Giants out-played the Patriots (during the Super Bowl/this season).
      d. Justin had to out-sing Kelly (in the course of an evening/episode/season) to win.

Differentials are prohibited because, as measure phrase adjuncts, they are the wrong kind of meaning to combine with non-gradable predicates. For evidence of adjuncthood, note that passivization of the measure phrase is robustly ungrammatical (cf. §2.1.2).

(39) a. *4 pies were out-eaten Mary by John.
      b. *6 books were out-bought Alan by Eric.
      c. *10 essays were out-written me by Simon.

Much like *more* is assumed to be the morphological spell-out of **many** plus -ER, *out-buy* can be taken as the spell-out of **buy**$_{gp}$ plus OUT-.

(40)

$[\![\text{OUT-}]\!](\![\mathbf{Mary}]\!) = [\lambda y \lambda f \lambda d \lambda x. max(f)(x) - max(f)(y) \geq d](\text{Mary})$
$= \lambda f \lambda d \lambda x. max(f)(x) - max(f)(\text{Mary}) \geq d$

$[\![\text{OUT-} \quad \mathbf{Mary}]\!](\![\mathbf{buy}_{gp}]\!) = [\lambda f \lambda d \lambda x. max(f)(x) - max(f)(\text{Mary}) \geq d]([\lambda d \lambda x. \text{BUYING}](x) \geq d])$
$= \lambda d \lambda x. max(\text{BUYING})(x) - max(\text{BUYING})(\text{Mary}) \geq d$

$[\![\text{ OUT- } \mathbf{buy}_{gp}\mathbf{Mary}]\!](\![\mathbf{6\ books}]\!) = [\lambda d \lambda x. max(\text{BUYING})(x) - max(\text{BUYING})(\text{Mary}) \geq d](\text{6 books})$
$= \lambda x. max(\text{BUYING})(x) - max(\text{BUYING})(\text{Mary}) \geq \text{6 books}$

John out-bought Mary by 6 books holds just in case the gap between John's buying and Mary's buying measures 6 books.

Some outstanding problems: why *out-nice* but not **out-mean* (cf. *?out-nasty*), *out-smart* but not **out-stupid*, etc. Or is *out-* prefixation always OK and something else is governing the coercion? (polarity?)

5 Conclusions

To account for the Vietnamese data, I have argued:

(1) measure phrase differentials are adjuncts (a la Schwarzschild 2004);

(2) they are licensed by a quantized eventive reading of the predicate;

(3) this type-shift is induced by the semantics of the comparative.

A similar type-shift appears to be active in the distribution of English *out-* prefixation.

An outstanding issue: at the moment, **6 cuốn sách** requires two different denotations: an argument meaning like $\exists x.\mathbf{book}(x) \wedge |x| = 6$, and an adjunct meaning as a degree-denoting measure phrase viz. *$5, 5 feet* as measure phrases vs. *$5, 5 feet* as arguments. One way around this might be to push on the idea that *all* (or many) predicates are *always* gradable, i.e. *Linh mua sau cuốn sách* really has the meaning "Linh's degree of CUỐN-buying is six books". More work on the distribution of the classifier is necessary here.

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