

# Scalar Properties of Degree Modification in Karitiana: Evidence for Indeterminate Scales

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**Abstract.** The aim of this article is to give evidence for the existence of a new parameter for the typology of degree predicates: the indeterminacy of scales. The arguments are based in the analysis of the semantic behavior of the degree modifier *pitat* in Karitiana - a native Brazilian language.

## 1 Introduction

This paper focusses on the scalar properties of a specific verbal construction in Karitiana: degree modification with the adverb *pitat* ‘a lot’ in sentences like (1)<sup>1</sup>.

- (1) Taso  $\emptyset$ -na-pytim’adn- $\emptyset$  pitat.  
man 3-DECL-work-NFUT a.lot  
‘The man worked a lot’

*Pitat* is a degree modifier that has some particular characteristics. It only combines with atelic verbal predicates, and the modified sentences are adequate in a range of situations related to a high degree in many dimensions, such as duration in time, number of occurrences, intensity, speed, and distance.

The main claims of this paper are (i) *pitat* in Karitiana does not behave like other degree modifiers such as *beaucoup* in French or *a lot* in English; (ii) the data from Karitiana support a degree-scale semantics for degree modification, and (iii) the traditional typology of gradable predicates based on the closure of the scales and their relation with a standard of comparison can be improved by introducing a further dimension: the distinction between determinate and indeterminate scales.

## 2 Degree Modification in Karitiana

The aim of this Sect. is to present the distribution of *pitat* ‘a lot’ in Karitiana. Only atelic verbal predicates can be modified by *pitat*. Sentences (2) and

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<sup>1</sup>Karitiana is a native language of the Arikén family, Tupi stock, spoken by about 320 people on a demarcated area in the northwest of Brazil (Storto and Vander Velden [2005]).

(3) with activity and stative predicates are grammatical. Accomplishment and achievement predicates as in sentences (4) and (5), on the other hand, cannot be modified by *pitat*.

- (2) Milena  $\emptyset$ -na-aka-t            i-tarak-t            pitat.  
 Milena 3-DECL-COP-NFUT PART-walk-ABS. a.lot  
 ‘Milena walked a lot’
- (3) Inacio  $\emptyset$ -na-aka-t            i-osedn- $\emptyset$             pitat.  
 Inacio 3-DECL-COP-NFUT PART-be.happy-ABS. a.lot  
 ‘Inacio was happy a lot’
- (4) \*Inacio  $\emptyset$ -na-aka-t            i-tat- $\emptyset$             pitat Porto Velho pip.  
 Inacio 3-DECL-COP-NFUT PART-go-ABS. a.lot Porto Velho to  
 ‘Inacio went a lot to Porto Velho city’
- (5) \*Inacio  $\emptyset$ -na-aka-t            i-horop- $\emptyset$             pitat ep    opy ty.  
 Inacio 3-DECL-COP-NFUT PART-reach-ABS. a.lot tree top OBL  
 ‘Inacio reached a lot the top of the tree’

The distribution above is similar to what we find with *a lot* in English (as described in Caudal and Nicolas [2005]).

- (6) Yanning walked a lot.  
 (7) \*Yanning ate his pancake a lot.

(Caudal and Nicolas [2005], p.5)

Nevertheless *pitat* has an unexpected characteristic: it can be easily used in a much wider range of interpretations. Thus, sentence (2) can be used to describe the following situations: (i) Milena walked for a long time; (ii) Milena walked a lot of times; (iii) Milena walked in high speed; (iv) Milena walked for a long distance; (v) Milena walked with pleasure. And sentence (3) felicitously describes situations in which: (i) Inacio was happy for a long time; (ii) Inacio was happy a lot of times; (iii) Inacio was very happy.

So, an appropriate analysis for *pitat* has to account for these two characteristics: (i) the distribution with only atelic predicates; and (ii) the diversity of possible interpretations. The analysis proposed in the next Sects. attempts to capture these two features.

### 3 Degree Modification in Karitiana Cannot be Explained by the Mass/Count Distinction in the Verbal Domain

Degree modifiers conveying high degree are usually sensitive to the mass/count distinction in the domain they modify. *Much* and *many* are the classical example (Chierchia [1998]). One could be tempted to suggest that the distribution of *pitat*

can be explained by this regularity. The degree adverb *beaucoup* in French, for example, was investigated by Doetjes [2007] in these terms. The author follows Bach [1986] in arguing that the same mass/count distinction we find in the nominal domain can be found in the different types of verbal predicates. Roughly the proposal is that telic verbal phrases (accomplishments and achievements) can be considered countable predicates and atelic (activities and states) can be taken as massive.

*Beaucoup* has a different behavior depending on the kind of predicate that it modifies. When it is used with a telic predicate, as in example (8), the sentence has an iterative interpretation, by which many events occurred. In sentences with atelic predicates, as in (9), the sentence can have an iterative interpretation or a degree interpretation (Doetjes [2007]).

- (8) Pierre va beaucoup au Louvre.  
 Pierre goes a.lot to.the Louvre  
 ‘Pierre goes to the Louvre a lot (many times)’
- (9) Il a plu beaucoup.  
 It has rained a.lot  
 ‘It has rained a lot (many times or intensively)’

According to Doetjes [2007], the iterative interpretation of sentences with *beaucoup* has its origin in the count feature of the predicate. So in sentences like (8) the fact that only iterative interpretation is available is explained by the count nature of the predicate *aller au Louvre* ‘to go to the Louvre’. Regarding the sentences with atelic predicates, like *pleuvoir* ‘to rain’ in (9), when they have a degree interpretation, it is on account of the massive nature of the verbal predicate, but when they have an iterative interpretation, it is because the massive predicate shifted from mass to count. This type-adjustment is the price to pay for the assumption that the iterative interpretation in sentences with degree adverbs has its origin in the count nature of the predicate.

This analysis is not adequate to explain the Karitiana data. Firstly, there are more than only two readings associated with degree modification in Karitiana. All the interpretations available for sentences with *pitat* are equally important and none of them should be explained by an exception rule, like ‘shift the predicate’ from mass to count. It is not the case that one of the readings is available by one rule and the others by another one. *Beaucoup* has a binary behavior (concerning its interpretations), so it makes sense to capture it by a binary rule (mass/count distinction). *Pitat* has not a binary behavior with atelic verbs, then it should not be explained by a property like the mass/count distinction.

As the next Sect. will show, the iterative interpretation can be considered as being part of the degree modification. I will argue that iterativity in sentences with *pitat* is built on one of the possible scales associated with degree modification, and it is not an operation on the verbal domain that competes with the degree one.

## 4 Degree Modification in Karitiana and Degree-Scale Structures

The aim of this Sect. is to argue that scalar structures are the proper way to deal with degree modification in atelic constructions in Karitiana. It will be shown that a degree-scale semantics can account for both the distribution and meaning of *pitat*.

Degree modification can be understood as an operation on gradable predicates. Following Kennedy [1999], I will consider gradable predicates as predicates that have a degree argument and a scalar structure<sup>2</sup>. Kennedy and McNally [2005] argue that there are two parameters that are crucial to the typology of degree predicates: the closure of their scales and their relation to a standard of comparison.

The first parameter divides the scales into open and closed ones. Open scales do not have a minimum or a maximum degree lexically determined. The adjective *high*, for example, has an open scale since it has no lexically defined minimum or maximum degree. On the other hand, closed scales have a well determined minimum and maximum degree. For example, *full* and *empty* are closed scales adjectives. The scales related with these adjectives have a minimum degree, associated to *empty* and a maximum one associated to *full*.

The second important parameter of the typology of degree predicates is described by their relation to the context. Relative degree predicates are dependent on a contextual standard of comparison in order to be interpreted; absolute ones, by contrast, do not have a context dependent standard of comparison. For instance, the adjective *high* is a relative predicate because its denotation in a sentence varies according to the context. On the other hand, an adjective such as *closed* does not have the standard of comparison defined by the context. Kennedy and McNally [2005] claim that there is an relation between the parameters - gradable adjectives that have totally open scales have relative standards, whereas gradable adjectives that have totally or partially closed scales have absolute standards. Since I am dealing with degree modification of verb phrases, this typology, which is widely used in the studies of gradable adjectives, must be applied to the verbal domain. Caudal and Nicolas [2005] assume that there is a relation between event structure and scale closure. They apply the distinction open/closed to the verbal domain and claim that telic verbal predicates, since they have a final point given by the *telos*, can be considered as having closed scales. On the other hand, atelic predicates are open scale predicates since they do not have a lexically defined end point (*telos*).

As it was shown in Sect. 2, *pitat* can be used only with atelic verbal predicates. We may rephrase the restriction by saying that it applies only to open scale predicates. This is precisely the same restriction of the degree modifier *very* in

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<sup>2</sup>A scale is a set of degrees ordered along a dimension. It can be understood metaphorically as a ruler formed by degrees ordered in a certain dimension (that can be, for instance, weight, temperature, length).

English as described in Kennedy and McNally [2005]<sup>3</sup>.

(10) Kim was very worried by the diagnosis.

(11) ??Beck is very acquainted with the facts of the case.

So far this is the distribution of *pitat* according to a theory that assumes scalar structures. In what follows, I will develop a proposal to account for how the multiple readings associated to the sentences with *pitat* are built.

Intuitively, there is a difference between degree modification of the adjectival and in the verbal domain. When one says ‘Mary is very beautiful’, it is clear that the dimension of the scale involved in the interpretation of the sentence is easily made available by the adjective: the sentence is evaluated relative to a scale of beauty. But when one say in Karitiana ‘*Taso napytim’adn pitat*’ (‘The man worked a lot’), the proper scale for the evaluation of the truth conditions of the sentence is not obvious, but must be filled by context.

This intuition can be formally captured by the theory of degree and scalar structures. The scales formed in constructions with adjectives are scales available in the lexicon (cf. Kennedy [1999]). This explains the similarity between the adjectives and the scales related to them. *High* is related to the scale of height, *happy* is associated to the happiness scale, and so on. Activity verbs, in turn, like the verb *to work* do not lexically encode a scale. There is no “workness” scale lexically associated to the verbal predicate. However, this does not mean that verbal constructions of this type cannot be associated to a scale. The proposal submit is that the scales in these cases are contextually constructed rather than given by the lexicon.

I assume, following Dowty [1979], that activities are dynamic predicates involving complex changes, that is a combination of changes in several possible dimensions<sup>4</sup>. The variety of the dimensions associated to complex change predicates is responsible for the variable range of scales related to these predicates and therefore for the multiple readings of the sentences in which they appear.

The variety of dimensions can be formally captured by the tools provided in the works on degree-scales by what Kennedy and McNally [2005] called *indeterminacy*. Indeterminacy is the capacity of a predicate to be compatible with scales of various dimensions. The different measurable dimensions of an event denoted by an atelic verbal predicate – as duration in time, number of occurrences, number of participants, intensity, etc. – can be used to fill in the dimensions of the scales.

<sup>3</sup>See Kennedy and McNally [2005] for details.

<sup>4</sup>In fact, I extend the idea of complex change predicates to all activity and stative verbs in Karitiana since they have the same behavior in *pitat*’s constructions.

#### 4.1 Formalization Proposal for Degree Modification with *Pitat*

This Sect. intends to present my proposal of formalization for the degree modifier *pitat*. As stated before the idea I adopt is that scales associated to atelic predicates (activity and states) are not given in the lexicon, but are provided by context. Since *pitat* only modifies atelic predicates, it only operates on contextual scales. Since scales are sets of degrees, this suggests that the degree that this adverb selects is not present in the lexical representation of the predicates it modifies. See below the traditional lexical entry for *to walk* in (12) and compare to *beautiful* in (13).

$$(12) \quad \llbracket walk \rrbracket = \lambda e. walk(e)^5$$

$$(13) \quad \llbracket beautiful \rrbracket = \lambda d. \lambda x. beauty(x) = d$$

However, in order to be modified by *pitat*, the degree argument must be present somehow in verbs like *tarak* ‘to walk’. I assume following Caudal and Nicolas [2005] that atelic predicates may have a degree argument, although it is not present in the lexicon. Piñón [2000] claims that there is possible to give a degree argument to verbal predicates in the course of the semantic composition by a degree function. Following his idea I postulate a function **DegP** – in (14) – that takes a simple predicate of events and returns a relation between degrees and events<sup>6</sup>. To capture the indeterminacy of the scale, a measure function  $\mu$  is used as a variable for dimensions (cf. Krifka [1998], Thomas [2009]).

$$(14) \quad \llbracket DegP \rrbracket = \lambda P_{\langle s,t \rangle}. \lambda d. \lambda e. P(e) \ \& \ \mu(e) = d$$

In (10)  $\mu$  can be replaced by temporal duration, event cardinality, speed, distance or intensity<sup>7</sup>. The DegP function has a double role. Besides adding a degree argument to the predicate, it also functions as a restriction in the domain of *pitat*. Since *pitat* can occur only in sentences with predicates of open scales, I assume that DegP is a function that can be applied only to open scale predicates. I propose the following lexical entry for *pitat*:

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<sup>5</sup>I assume a neo-davidsonian semantic of events that consider verbs as predicates of events (cf. Parsons [1990]). Furthermore, I follow Kratzer [1996] in the assumption that the external argument is inserted in the syntax.

<sup>6</sup>The crucial difference between the degree function I postulate and the one suggested in Piñón [2000] is that his formula maps events, objects and degrees of accomplishment predicates. The degree function I suggested in (10) can be applied only to atelic verbal predicates and it says nothing to the relation between the objects and the events or degrees. Its purpose is to give a degree argument and a variable of scale to the predicate.

<sup>7</sup>In the way the formula is given it is over-generating because all verbs can be associated to any dimension. The next step of the investigation will be to find lexical constraints to fix this, since, of course, not all verbs have distance and high speed readings, for instance.

- (15)  $\llbracket pitat \rrbracket = \lambda G_{(d, \langle s, t \rangle)} \cdot \lambda e. \exists d. [ d \geq N \ \& \ G(d)(e) ]$   
 where: N = normal degree of the scale

So the formalization proposed here exploits the idea in Caudal and Nicolas [2005] that the degree modifiers can restructure or introduce scales during the derivation combining lexical, syntactic and semantic information.

## 4.2 Some Consequences of the Proposal

In this Sect., some consequences of the proposal presented above are discussed. The first one relies on the iterative versus degree interpretations (as discussed in Sect. 3). Returning to Karitiana data, with the assumption of indeterminacy of scales it is possible to explain the iterative reading as part of the degree modification, without postulating a type-shifting rule on the predicate as suggested by Doetjes [2007]. Thus unlike Doetjes [2007] iterativity is considered a subtype of degree modification, and not an operation that competes with it. In fact, in the proposal assumed in that there is no degree interpretation. There is a degree modification and there are iterative and intensity interpretations that are generated by the degree operation.

The second consequence of the idea that constructions involving gradable adjectives have scales whose dimension is lexically specified; while constructions involving verbs have contextual ones is that degree modification in the former constructions is less complex than in the latter. The application of a degree adverb like *very* to an adjective like *beautiful* is just an operation of modification on the lexicalized scale of beauty. The degree modification of a verb, on the other hand, involves a few more steps. For something like *to run a lot* be interpreted, it is necessary that the appropriate scale of the verb is formed and only then the construction can be evaluated. In this very distinction lies the difference between English *very* and *a lot*. Insofar as *very* is a modifier that can be applied only to lexical scales, *a lot* is an adverb that forces the predicate to have a degree argument in order to be used. The assumption that degree modification in the adjectival domain is less complex than modification in the verbal domain is supported by other works in the degree-scale literature. Bochnak [2010] analyzes the degree modifier *half* and posits some semantic functions that are necessary to the modification of verbs and are not used to modify adjectives<sup>8</sup>.

The last consequence that will be discussed is the importance of indeterminacy to the typology of degree predicates. Starting from the idea that constructions involving gradable adjectives such as *beautiful* have scales available in the lexicon, while constructions involving verbs like the ones I am dealing with have scales built in the context, the first issue that arises is a problem in the description of the distribution of *pitat*. Previously I claimed that *pitat* selects open scale predicates. But, in fact, the predicates that are modified by *pitat* do not have a scalar structure before the modification. So it is necessary to slightly reformulate that claim. In fact, *pitat* selects predicates that can have an indeterminate

<sup>8</sup>See Bochnak [2010] for details.

scale and this is the relevant property for both its distribution and meaning. The indeterminacy of scales is as important to the scales' typology as their closure and their relation to the standard of comparison. This is the main theoretical contribution of this work: besides the well-know parameters of open/closed and relative/absolute predicates, the indeterminate/determinate property is also important.

In fact, since there is a one-to-one correspondence between the two parameters described in Kennedy and McNally [2005], there is no reason to consider them as two different parameters. They can be treated as a single parameter described in two different ways. The relative vs. absolute distinction is a characteristic of degree predicates whereas the open vs. closed distinction is a characteristic of their scalar structure. On the other hand, indeterminacy is an independent parameter since it allows for crossed combinations with the other(s).

The table resumes the proposal with examples (adjectives and verbs)<sup>9</sup>:

	(In)determinacy	Adjective	Verb
<b>Open Scale</b>	Determinate	high	to melt (atelic reading)
<b>Relative Predicate</b>	Indeterminate	big	to run
<b>Closed Scale</b>	Determinate	full	to melt (telic reading)
<b>Absolute Predicate</b>			

The proposal is that if a gradable predicate is absolute and it has a closed scale, it necessarily has a determinate scalar structure, there is, its scale is given by lexicon. If a predicate is relative, it can have a determinate or an indeterminate scale. The adjective *high* is the classical example of an open scale adjective with determinate scale (scale of height). The verbs treated in this paper as *to run*, on the other hand, are open scale predicates with indeterminate scales (scales of speed, distance, iterativity, intensity, etc.).

## 5 Conclusions

This paper argues that the number of parameters that classify degree predicates must be enlarged in order to include also the determinate/indeterminate distinction. Thus the degree modification with *pitat* in Karitiana can be properly analyzed in a degree-scale semantics. The analysis proposed assumes that atelic predicates are verbs of complex changes that are composed by changes in several possible dimensions (speed, distance, iterativity, intensity) which are made available by the scales' indeterminacy.

The proposal has some consequences. First, iterative interpretations in sentences with *pitat* are properly described by a degree modification operation, without the postulation of a type-shifting rule on the predicates. Secondly, the predictions that degree modification in the verbal domain is in a certain way more complex than in the adjectival domain is in accordance with other works in the same field. And finally, the investigation of degree modification with *pitat* in

<sup>9</sup>For degree achievements ambiguity see Hay et al. [1999]

Karitiana helped to reach a new theoretical claim: the determinacy of scales is as important to their typology as their closure and their dependence from the contextual standart.

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