

RESEARCH

The roots of measurement

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In addition to roots for familiar classes like verb, noun, and adjective, Mayan languages have a class of roots traditionally called “positional”. Positional roots are distinct from other roots most prominently in terms of requiring derivation into stems of one of the more familiar categories to be used. The goal of this work is to show that the behavior of positionals follows from semantic facts, in particular, the fact that they denote measure functions of type $\langle e, d \rangle$. This conclusion is supported through a series of novel arguments from the Mayan language Kaqchikel that positional roots have a scalar semantics. It then argues for the type $\langle e, d \rangle$ analysis by contrasting them with gradable root adjectives, which similarly make reference to ordered degrees on a scale, but which have a relational type—namely, $\langle d, et \rangle$. I then show that a core function of positional morphology, and the morpheme that derives positional stative predicates in particular, is to take positional roots into stems of type $\langle d, et \rangle$, which will account for the fact that derived positionals behave semantically like root adjectives. In this way, this work not only presents a novel account of the Mayan data, but provide additional evidence for the proposal that even within languages there can be differences in the fine-grained compositional structure of degree-denoting expressions.

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1 Introduction

Two fruitful strands of research have recently come to prominence in the degree semantics literature. First, there has been a push to discover degree-denoting expressions across morphosyntactic categories and to account for them in a unified theory. That is, while adjectives present the canonical case, even a small sample of recent work shows that certain verbs (Hay, Kennedy & Levin 1999; Kennedy & Levin 2008), adverbs (Rett 2011), nouns (Schwarzschild 2005; Morzycki 2009; Champollion 2010), quantifiers (Hackl 2000; Rett 2008; Solt 2014; Wellwood 2015), and even modals (Yalcin 2010; Lassiter 2011) must make reference to ordered degrees on a scale. The second strand has focused on crosslinguistic morphological variation in degree constructions. The aim is to uncover the basic ingredients for a theory of degree-denoting expressions and to understand how they compose (Beck et al. 2009; Schwarzschild 2010; Grano 2011; Bochnak 2013; Bogal-Allbritten 2013: among others).

The present work fits squarely within both of these research programs. It centers on an enigmatic class of roots in Mayan languages called *positionals*. A few examples of positionals from the Mayan language Kaqchikel are presented in (1).¹

¹ Kaqchikel is an eastern-branch Mayan language spoken by well over half a million people in the western highlands of Guatemala (Richards 2003). Unless otherwise cited, all of the data presented here comes from my own fieldwork on the varieties of the language spoken in Comalapa, Patzún, and Santiago.

- (1) POSITIONALS
- a. \sqrt{jot} ‘elevated’
 - b. $\sqrt{ch'eq}$ ‘wet’
 - c. \sqrt{set} ‘circular’
 - d. \sqrt{tun} ‘adjacent’
 - e. \sqrt{tik} ‘facing a reference point’

Positional roots stand out from all other roots classes in the language, primarily in terms of morphology, but also in terms of lexical semantics. The goal of this work is to show that positional roots, and their behavior in both derived and underived forms follows if they denote measure functions of type $\langle e, d \rangle$. Crucially, with this analysis it is possible to explain the ways they contrast with adjectives in the language, which similarly make reference to ordered degrees on a scale, but which have a relational type—namely, $\langle d, et \rangle$. In this way, I not only present a novel account of the Mayan data, but provide additional evidence for the proposal that even within languages there can be differences in the fine-grained compositional structure of degree-denoting expressions.

To build this argument, though, and to see how it sheds light on the grammars of Mayan languages, it is first necessary to consider some basic Mayan morphosyntax. Mayan language morphology is built around a privileged class of roots of form CVC.² In the canonical case, these roots all correspond to stems of some familiar category, which is diagnosed through a combination of derivation and inflection. For instance, the roots in (2) are transitive verbs roots because they can be immediately inflected with ergative and absolutive agreement in a transitive clause like (3a) or derived with the passive like in (3b), while none of the roots in (4), (6), or (8) can be similarly inflected or derived. The pattern of facts has been replicated across examples (4–8). For each class of roots, I have illustrated examples of inflectional and derivational morphology that none of the other roots present can immediately take.

- (2) TRANSITIVE VERBS
- a. $\sqrt{b'än}$ ‘do/build’
 - b. $\sqrt{tz'ët}$ ‘look at’
 - c. $\sqrt{chäp}$ ‘handle’

- (3) a. X-at-in-tz'ët.
CP-A2S-A1S-see
‘I saw you.’
- b. X-i-tz'et.
CP-A1S-see.PAS
‘I was seen.’

- (4) INTRANSITIVE VERBS
- a. $\sqrt{wär}$ ‘sleep’
 - b. \sqrt{ok} ‘enter’
 - c. $\sqrt{käm}$ ‘die’

- (5) a. X-Ø-käm.
CP-A3S-die
‘He died.’

² Roots of this form are privileged in that they often take derivational or inflectional morphology that is not available for derived stems of the same category.

- b. X-Ø-ki-kam-isaj.
CP-A3S-E3P-die-CAUS
'They killed him.'
- (6) NOUNS
a. √b'aq 'bone'
b. √ch'ich' 'car'
c. √chäj pine 'tree'
- (7) a. nu-b'aq
E1S-bone
'My bone'
b. nu-b'aq-il
E1S-bone-ABST
'My very bones'
- (8) ADJECTIVES
a. √säq 'white'
b. √kow 'hard'
c. √nim 'big'
- (9) a. ri nim-äq che'
the big-PL tree
'the big trees'
b. X-Ø-nim-ir.
CP-a3s-big-INCH
'It got big.'

In addition to the root classes for these more familiar syntactic categories, Mayan languages like Kaqchikel have a class of roots that have been called *positional* in the descriptive literature. There are two pieces of evidence to support grouping them as a separate root class. First, example (10) shows that positionals all have the canonical CVC root shape, just like all the roots encountered thus far. Second, positional roots do not take any of the derivational morphology presented in (2–8), and in fact, have their own derivational morphology that none of the previous roots can take. In particular, the suffix –*vl* in (11a) derives a stative predicate, the suffix –*e'* in (11b) derives an intransitive verb, the suffix –*VC* in (11c) derives an adjective, and the suffix –*Vb'a* in 11d derives a transitive verb (García Matzar & Rodríguez Guaján 1997; Tummons 2010).³

- (10) POSITIONALS
a. √tzuy 'seated'
b. √ch'eq 'wet'
c. √set 'circular'
- (11) a. At ch'eq-ël.
A2S wet-P.STAT
'You're wet.'

³ See Kaufman (1990) for an early description of similar morphological diagnostics in the closely related language K'iche'.

- b. X-a-ch'eq-e'.
CP-A2S-wet-P.ITV
'You got wet.'
- c. ri ch'eq-ech'-äq ak'wal-a'
the wet-P.ADJ-PL child-PL
'the very wet children'
- d. X-e'-ru-ch'eq-eb'a ri ak'wal-a'.
CP-A3P-E2S-wet-P.TV the child-PL
'You got the children wet.'

Morphological considerations like these clearly categorize positionals as a separate root class on par with the roots in (2–8). There is one way, though, in which positionals stand out. Unlike the members of other classes, positional roots cannot appear zero-derived. Example (12) exemplifies this fact for the positional root $\sqrt{ch'eq}$, which just cannot be inflected without undergoing some kind of derivation. It thus contrasts with roots of other categories, as we've seen, but illustrated again in (13).

- (12)
- a. *At ch'eq.
A2S wet
'You're wet.'
 - b. *X-a-ch'eq.
CP-A2S-wet
'You got wet.'
 - c. *ri ch'eq-äq ak'wal-a'
the wet-PL child-PL
'the very wet children'
- (13)
- a. At nīm.
A2S big
'You're big.'
 - b. X-a-nīm.
CP-A2S-get.hungry
'You got hungry.'
 - c. ri nīm-äq ak'wal-a'
the big-PL child-PL
'the big children'

Two major questions follow from the fact that positional roots stand as a separate root class on par with roots for more familiar categories like verbs or adjectives, yet differ from these roots in needing derivational morphology for inflection. First, what kind of syntactic and semantic objects are positional roots and how do they relate to those of more familiar categories like adjective, noun, verb? Second, why do only positional roots need derivation? While these questions arise from rather parochial facts about Mayan language morphology, the answers have much wider consequences. For instance, positional roots have been used to argue against the universality of lexical categories. Evans & Levinson (2009: 435) take Mayan positionals to argue that languages can go beyond the “big four” word classes (noun, verb, adjective, adverb) to have boutique lexical categories. The type-driven semantic account of the peculiar morphological properties of positional roots that I develop undermines their proposal by providing an alternative explanation. I then argue, in the final section, that positional roots actually have the syntactic category of verb,

which is incompatible with Evans & Levinson (2009: 435), and thus removes an argument against the universality of lexical categories.

Additionally, the particular type-theoretic account I develop allows both positional roots and adjective roots to make reference to scales, but to do so in a way that accounts for their morphological and compositional differences. The analysis thus adds to the growing body of evidence that not only do languages differ in whether they make reference to degrees (Bochnak 2013), but that there are a variety of compositionally viable ways to do so (Bogal-Allbritten 2013). The situation in Kaqchikel is of interest precisely because, as I argue, this compositional variation can be transparently read off of the morphology. In particular, the crux of the analysis I propose is that degree-denoting adjective roots are relations of type $\langle d, et \rangle$, and so can take arguments directly, while positional roots denote measure functions of type $\langle e, d \rangle$, and thus need to be derived into a relational expression before being inflected. Positional-specific derivational morphology exists, in part, to do precisely this.

2 Positionals make reference to degrees

This section presents a series of distributional arguments that positional roots are scalar roots, that is, their denotations make reference to degrees on a scale.⁴

2.1 Positional lexicalization patterns

The first argument comes from facts about lexicalization. The claim is that for Kaqchikel, a language with otherwise few adjectives, positional roots lexicalize what adjectives do in English.⁵ Since adjectives in languages like English are the prototypical category with scalar semantics, a natural hypothesis is that positionals lexicalize these same scalar notions that such adjectives do.

First, though, consider the domain of adjectives in Kaqchikel and Mayan languages in general. Languages of the family tend to have small to medium-sized adjective inventories (England 2004). Kaqchikel is no different. Counts from Patal Majzul's (2010) Kaqchikel dictionary show that the language has around 80 morphologically simplex adjectives and around 40 root (CVC) adjectives from these categories, which is similar to what has been reported in other Mayan languages, like Mam (England 2004).⁶ Moreover, the adjectives they do have are those that are typologically common in languages with small to medium adjective inventories (Dixon & Aikhenvald 2004), namely colors, valuations, ages, dimensions, tastes, and physical properties.

- (14)
- a. COLOR: *käq* 'red', *xar* 'blue', *qän* 'yellow', ...
 - b. VALUE: *ütz* 'good', *itzel* 'evil', ...
 - c. AGE: *ojër* 'old', *k'ak'a* 'new', ...
 - d. DIMENSION: *nim* 'big', *ko'öl* 'small', *pim* 'thick' ...
 - e. GUSTATORY: *k'äy* 'bitter', *poqöm* 'spicy', *ki* 'sweet', ...
 - f. PHYSICAL PROPERTY: *tew* 'cold', *k'atän* 'hot', *äl* 'heavy' ...

⁴ Following Kennedy & McNally (2005), a **Scale** is a triple $\langle S, R, \delta \rangle$ where: S is a set of degrees, R is an ordering on S , δ is the dimension of measurement.

⁵ We don't mean to make a strong typological claim that languages must lexicalize scalar notions. For instance, Bochnak (2013) has argued that languages like Washo do not. We mean merely to say that in a language with few adjectives, but a large unfamiliar category of expressions, it makes sense to ask if those expressions do what adjectives do in languages that do, in fact, have large adjective inventories.

⁶ Recall that Mayan languages make a morphological distinction between the roots of a category, which always have a CVC form, and the morphologically simplex expressions of a category. There are no non-root positionals, but as we see here there are can be non-root (i.e., non-CVC), morphological simplex expressions of other categories, like adjectives.

Contrast this to languages with large adjective inventories, like English, which can have well over 500 items (Dixon & Aikhenvald 2004). While Kaqchikel does not have many hundreds of adjectives, it does have many hundreds of positionals. A count of Kaqchikel dictionaries gives just over 300 (Tummons 2010), while sources for other Mayan languages consistently give numbers in the 300–500 range (Knowles 1984; Kaufman 1990; Haviland 1994; Kaan Pixab’aj & Sis Ib’oy 2004). Most of these, following England (2004), lexicalize physical properties and dimensions.

If these large counts of positionals round out the space of adjectives in Mayan languages like Kaqchikel with otherwise few adjectives, then we expect them to lexicalize gradable notions. This is borne out in a corpus of 304 positional roots collected by Tummons (2010). I categorized the corpus by asking of each positional whether it lexicalized a *prima facie* gradable property, determined by its translation into English.⁷ We find that positionals fall into four classes with respect to *prima facie* gradability, though those positionals with some sort of gradable semantics outnumber those without 9 to 1.

The first group, exemplified in (15), are those positionals that translate into gradable predicates in English. These are the largest group and number about two hundred.⁸

- (15) GRADABLE ~ 200
- a. $\sqrt{ch'öx}$ ‘deformed (globular)’
 - b. $\sqrt{köt}$ ‘bent’
 - c. \sqrt{jech} ‘twisted’
 - d. $\sqrt{t'eb}$ ‘fat, wide’

The next group, which I call *partially gradable positionals*, lexicalize two two properties at once—a configuration and a physical property—one of which is gradable. Note that this is not an ambiguity, but a kind of co-predication. For instance, an individual that satisfies \sqrt{jil} must be both hanging while chubby. There are a few score of these.

- (16) PARTIALLY GRADABLE ~ 50
- a. \sqrt{jil} ‘hanging (chubby)’
 - b. $\sqrt{tär}$ ‘standing (broken)’
 - c. $\sqrt{qën}$ ‘reclining (fat)’
 - d. $\sqrt{läb}$ ‘hanging (thin, smooth)’
 - e. \sqrt{tziy} ‘heaped (fine)’

The next group of positionals, which number about thirty, appear to be *prima facie* non-gradable. The majority of these lexicalize predicates that characterize configurations.

- (17) NON-GRADABLE ~ 30
- a. \sqrt{pitz} ‘disembowled’
 - b. \sqrt{tur} ‘unarmed’
 - c. \sqrt{tziy} ‘seated’
 - d. \sqrt{pa} ‘standing’

The examples in (17) are at first pass problematic for a theory that wants to account for the properties of positionals in general by giving them a type $\langle e, d \rangle$ denotation. The prob-

⁷ Translation is not the best way to tell whether an expression is gradable, but it is useful for divining the shape a large class of expressions of an unfamiliar type. In subsequent sections I show that positionals which lexicalize gradable notions do in fact pass standard gradability tests.

⁸ Note that the entire positional corpus is given in the appendix.

lems are not as bad as they seem, though. First, it may be possible to assimilate many of these expressions to those in the last category, namely positionals associated with a two-point scale. In fact, this is what I will argue at the end of this section after treating the more common gradable positionals. Second, the exception arguably prove the rule. As we will see below, *prima facie* non-gradable positionals are less productive, which is consistent with them having a non-standard semantics, namely one that is scalar, but not gradable (i.e., involving only two points).

The last group of positionals in (18), which only number in the tens, stand between the non-gradable positionals like those in (17) and those with a gradable semantics like (15–16). They are non-gradable, but still have a scalar semantics, though one that makes use of two-point scales. As noted by Beavers (2008), who defends the idea of two point scalar change predicates, gradable predicates are just a subset of the scalar ones, namely those with multipoint scales. I thus do not count these positionals as gradable, but the formal account proposed in section 3 can cover these expressions. They can denote measure functions that map individuals to points on a two point scale.

- (18) TWO POINT SCALE ~ 10
- a. \sqrt{tzi} ‘lit’
 - b. \sqrt{chi} ‘off’
 - c. $\sqrt{k'as}$ ‘alive’

What these data show, summarized in the figure below, is that the most common kind of positional root lexicalizes physical properties or dimensions that are gradable adjectives in English. This supports the proposal that the class of positionals, at its heart, consists of expressions that make reference to degrees on a scale.

This conclusion is bolstered by a second argument concerning productivity. If the canonical positional is degree-denoting, we should expect that positional-specific morphology to also implicate a degree argument, predicting the *prima facie* gradable classes of positionals to be more regular. To get a rough measure of morphological stereotypicality, we can count how many of the four core positional derivations a root takes, where the four core derivations are the positional stative predicate derivation (e.g., (11a)), the positional adjective derivation (e.g., (11c)), the positional intransitive derivation (e.g., (11b)), and the positional transitive derivation (e.g., (11d)). The Figure 1 shows, for each root semantic type, how many derivations it takes, that is, how productive it is.⁹ What we see is that the prediction is borne out. The gradable positional roots are in general more productive.

Once again, the data show that those positionals that lexicalize gradable notions are not just the most common, but also the most morphologically stereotypical. This suggests again that we should take scalarity to be the lens through which we should look at positional roots and their derivational potential. While looking at the class of positionals as a whole through translations is illuminating, translations only hint at truth conditions. In the next section we zoom in on particular positional roots to show, through language internal tests, that they pattern like scalar expressions in more familiar languages. We will begin by focusing on the most common type of positional, those two-hundred or so with *prima facie* gradable semantics. At the end of this section we will return to the other three classes and show that they too can be folded into an account that takes positionals to uniformly have a scalar semantics.

⁹ Note that these data are summarized in the appendix for each root, showing which of the four core derivations are attested.

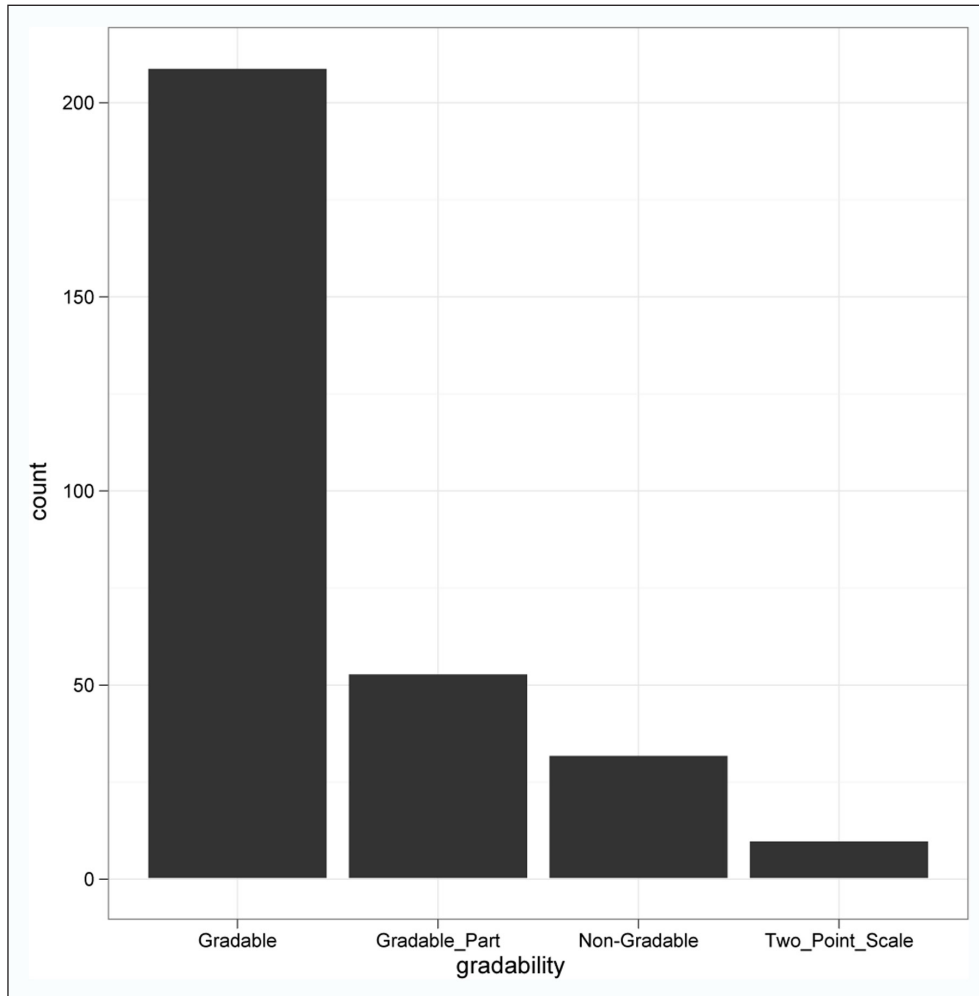


Figure 1: Root counts by semantic class.

2.2 Positionals in degree constructions

The second class of arguments, involving the first language-internal tests in favor of a degree semantics account of positionals, concern their widespread acceptability in degree constructions. I focus on the comparative because it is a robust test for degree-denoting expressions and its properties are well understood from a crosslinguistic perspective.

Kaqchikel comparatives look fairly standard from this crosslinguistic perspective. They consist of a gradable predicate (in (19) a root adjective), an optional degree morpheme borrowed from Spanish, and a locative morpheme introducing the comparative standard.

- (19) Ri a Xwan (más) n̄im ch-u-wäch xta Mariy.
 the CLF Juan (more) big PREP-E3S-face CLF Maria
 ‘Juan is bigger than Maria.’
 lit. ‘Juan is big(ger) in front of Maria’

While Kaqchikel comparatives are morphologically unsurprising, we must check whether they have the semantic properties required to diagnose gradable predicates. In particular, we must show that they make use of *explicit* comparison (Sapir 1944; Kennedy 2010: among others). Explicit comparison, as in (20), involves the direct comparison of the degrees individuals hold on a scale, making no claim as to whether the gradable predicate holds of the individuals in question.

- (20) John is bigger than Mary.
- a. $\max(\{d|\text{BIG}(\text{JOHN})(d) = 1\}) > \max(\{d|\text{BIG}(\text{MARY})(d) = 1\})$
 ‘John’s maximal degree on the scale of bigness is strictly greater than Mary’s maximal degree on the same scale.’

Explicit comparisons should thus be acceptable: (i) in *crisp judgment* contexts, where the topic of comparison does not stand out relative to the comparative standard, and (ii) with gradable predicates that have absolute minimum standards, which arguably do not make use of a comparison class (Kennedy 2007), though see Burnett (2012) for important recent arguments against this view. Examples (21–22) illustrate these properties for the English comparative. Example (21) shows that the standard comparative can be used even when the individual does not stand out relative to its comparative standard. In contrast, the *compared to* comparative, which is not an explicit comparative, is infelicitous in such contexts.

- (21) John and Mary are basically the same size, but John weighs a couple of pounds more and is a centimeter taller.
- a. John is bigger than Mary.
 b. #John is big compared to Mary.
- (22) Rod A is bent at a 30° angle and Rod B is bent at a 10° angle.
- a. Rod A is more bent than Rod B.
 b. #Rod A is bent compared to Rod B.

The Kaqchikel comparative can be used both in *crisp judgment* contexts as well as with minimum standard predicates. This shows that we are dealing with a bona fide explicit comparative that should only compose with scalar expressions. Moreover, we can make this point using positionals, which shows that they are such scalar expressions. Example (23) shows the felicity of a positional (in stative predicate form, which we return later), in a *crisp judgment* comparative. Example (24) shows the same for an absolute positional, namely one associated with a bounded scale.

- (23) Suppose you’re trying to help a friend decide which pencil to buy. The red one is a few cents more than the blue one. Can you say:
- a. Ri kãq **jot-öl** r-ajil ch-u-wäch ri xar.
 the red **elevated-P.STAT** E3s-price P-E3s-face the blue
 ‘The red is more expensive than the blue.’
 lit. ‘The red one’s price is higher than the blue one’s.’
- (24) Suppose you have two sticks for getting things down from the high shelves in your store. Neither is straight, but one is more bent than the other. Can you tell me which is which by pointing and saying:¹⁰
- a. La xat’at’ la’ **kot-öl** ch-u-wäch ri jun chik.
 that staff there **bent-P.STAT** P-E3s-face the one other
 ‘That forked staff there is more bent than the other one.’

These examples provide a strong argument that the Kaqchikel comparative expects scalar expressions, which positionals provide (along with adjectives like in 20). Putting aside the

¹⁰ We know that *kotöl* ‘bent’ is a minimum standard predicate because its negation entails the truth of its antonym, *choj* ‘straight’.

non-gradable and two-point-scale positional roots, in general we can use positionals in the explicit comparative construction, as we see with the following additional examples.

- (25) Ru-chi ri jay **jaq-äl** ch-u-wäch ru-chi ri ch'ich'.
 E3S-door the house **open-P.STAT** PREP-E3S-face E3S-door the car
 'The door to the house is more open than the door to the car.'
- (26) Ri ala' **ch'eq-äl** ch-u-wäch ri xtän.
 the boy **wet-P.STAT** PREP-E3S-face the girl
 'The boy is more wet than the girl.'
- (27) Ri pa's **pach'-äl** ch-u-wäch ri po't.
 the belt **rip-P.STAT** PREP-E3S-face the blouse
 'The belt is more ripped than the blouse.'

These facts show that the vast majority of positionals, which were *prima facie* gradable under translation, are in fact so. They freely occur in the comparative construction, which is a standard diagnostic for gradability.

2.3 Positional-specific degree morphology

The third class of arguments for a scalar account of positionals is even more language-specific, and even positional-specific. In particular, the the argument in this section comes from positional-specific morphology, which I will argue is degree morphology. In particular, I will be interested in comparisons between morphology that only applies to positional roots and degree modifiers like *very*, *slightly*, *completely*, etc. in languages like English.

One of the most beautiful results in the literature on scalar expressions, like gradable adjectives, is that scales themselves are not uniform. They can have their own particular structures, for example being closed on either (or both) ends, and that this structure can be diagnosed through their interaction with scalar modifiers. For example, *completely* in English takes a measure and derives a predicate of individuals satisfiable by only those entities that are mapped by the measure to the maximal degree on its associated scale (Kennedy & McNally 2005).

- (28) completely $\rightsquigarrow \lambda m_{ed} \lambda x [m(x) = \mathbf{max}(m)]$

This correctly predicts that only those gradable predicates that denote functions from entities to degrees on an upper-closed scale should be grammatical. An adjective like *fast*, which isn't associated with a scale with the appropriate structure, is infelicitous when modified by an expression like *completely*, which makes reference to scales with upper bounds.

- (29) a. The car is completely full.
 b. #The car is completely fast.

These observations set up an empirical prediction about positional roots. If positionals are scalar expressions, we should find evidence that positionals fall into different classes based on scale structure. Moreover, positional-specific morphology is potentially sensitive to the scale structure of the positional it derives. We will see that both of these are true, which bolsters the argument that positionals are scalar expressions. It also allows us to solve a puzzle. Recall from Figure 2 that while *prima facie* gradable

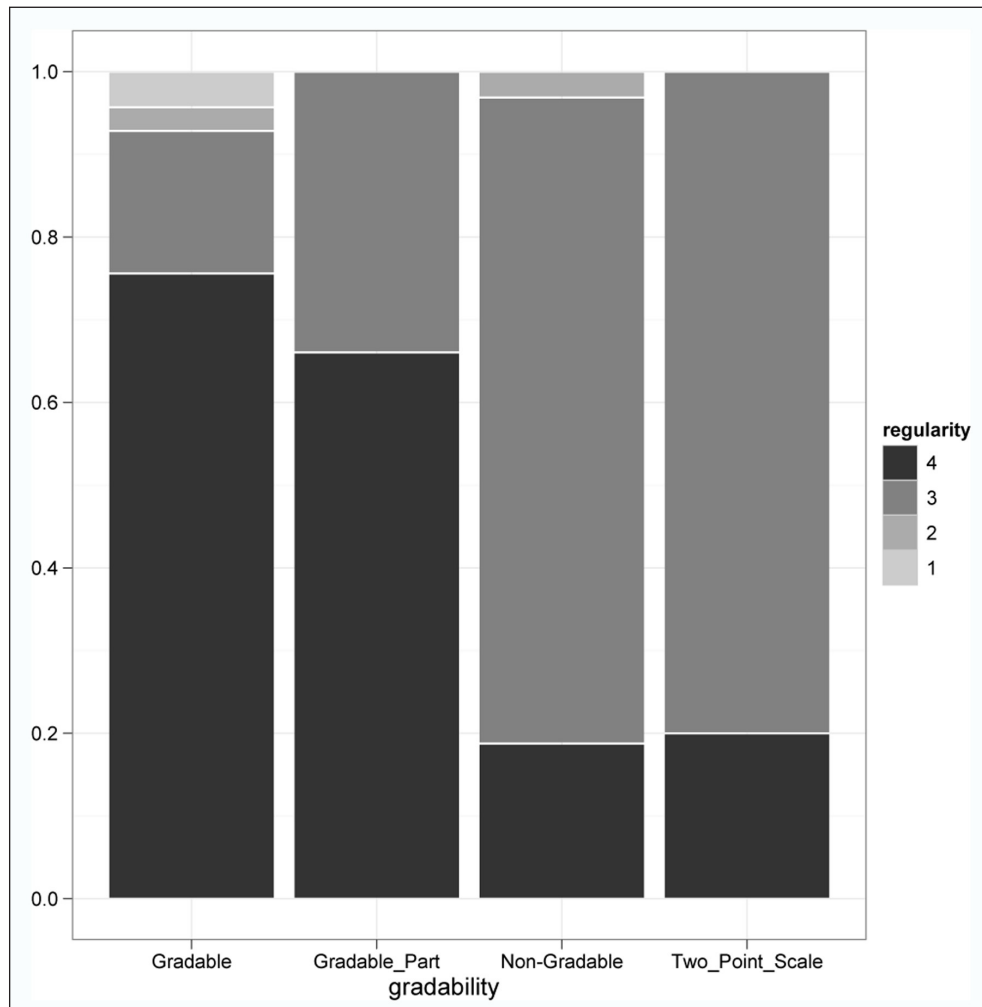


Figure 2: Regularity by semantic class.

positionals are more productive, there are still those that cannot combine with certain core positional derivations. I show here that we can make sense of these gaps if certain positional derivations are sensitive to scale structure, and not all positional have the same scale structure.

Our focus will be the the positional adjective derivation. Recall from example (11c), repeated in (30), that the reduplicative suffix $-VC_1$ derives positional roots into adjectives. We know (30) is an adjective because: (i) it occurs between a determiner and its noun complement, and (ii) it bears the adjectival plural agreement suffix $-äq$.

- (30) *ch'eq wet*
 ri *ch'eq-ech'-äq ak'wal-a'*
 the wet-P.ADJ-PL child-PL
 'the very wet children'

Moreover, the morphology is positional-specific in that it cannot be used to modify an adjective or derive adjectives from other root categories.

- (31) a. **nim-anäq* 'very big (PL)'
 b. **saq-asäq* 'very white (PL)'

- (32) a. **war-awäq* 'very sleepy (PL)', from *war* 'to sleep'

The fact that (30) is translated with the degree modifier *very* already suggests that $-VC_1$ has a degree flavor. More minimal pairs reveal that this is a general pattern.

(33) Tummons (2010: ex. 135)

- a. \emptyset b'uy-ül.
A3s soft-P.STAT
'It's soft.'
- b. \emptyset b'uy-üb'-ik.
A3s soft-P.ADJ-SG
'It's very soft.'

(34) Tummons (2010: ex. 136)

- a. \emptyset chuk'-ül.
A3s stiff-P.STAT
'It's stiff.'
- b. \emptyset chuk'-üch-ik.
A3s soft-P.ADJ-SG
'It's very stiff.'

(35) Tummons (2010: ex. 136)

- a. \emptyset jech'-ël.
A3s twisted-P.STAT
'It's twisted.'
- b. \emptyset jech'-ëj-ik.
A3s twist-P.ADJ-SG
'It's very twisted.'

Supporting the translation is the fact that the positional adjective form asymmetrically entails the positional stative form. This is expected if $-VC_1$ is intensifying, that is, if it raises the contextual standard for the gradable expression, as its translation suggests.¹¹

(36) a. \emptyset b'uy-ül, po man \emptyset b'uy-üb'-ik ta.
A3s soft-P.STAT, but NEG A3s soft-P.ADJ-SG IRR
'It's soft, but it's not very soft.'

b. # \emptyset b'uy-üb'-ik, po man \emptyset b'uy-ül ta.
A3s soft-P.ADJ-SG, but NEG A3s soft-P.STAT IRR
'It's very soft, but it's not soft.'

(37) a. \emptyset jech'-ël, po man \emptyset jech'-ej-ik ta.
A3s twist-P.STAT, but NEG A3s twist-P.ADJ-SG IRR
'It's twisted, but it's not extremely twisted.'

¹¹ In doing elicitation of large numbers $-VC_1$ positionals across 8 Kaqchikel speakers, I have noticed that while standard-raising is the most common effect, some positionals under the $-VC_1$ instead indicate permanence of the condition. This is even true for the same positional across speakers. For instance, *jechejik* in (35b) for some speakers means that object of predication is not greatly twisted, but permanently twisted. My current hypothesis is that $-VC_1$ is ambiguous between a stage-level and individual-level predicate derivation, and only the former case is it standard-raising degree morphology. In contrast, the stative derivations seems to always have the stage-interpretation. This suggests that the stativizing morphology, in addition altering the type of positional roots additionally adds a state argument, which does not occur with the positional adjective derivation. That said, I will save the exploration of individual-level readings of positional adjectives for future work, and for now focus on the degree reading, which is prominent, and deserves its own account.

- b. # \emptyset jech-**ej**-**ik**, po man \emptyset jech'-**el** ta.
 A3s soft-P.ADJ-SG, but NEG A3s soft-P.STAT IRR
 'It's extremely twisted, but it's not twisted.'

This is enough to establish that the positional adjective derivation is standard raising relative to the current context. In the next section, after introducing the formal account of positional roots, I will provide a formal account of the particular flavor of standard raising we see with the positional adjective derivation. Instead, now we will consider how the particular kind of standard-raising instantiated by the positional adjective derivation interacts with scale structure, which will establish that the positional adjective derivation is degree morphology.

First, consider those positionals that are *prima facie* non-scalar, that is, non-gradable and not associated with a two point scale. In virtue of being related to no scale, we expect they should be infelicitous with the positional adjective derivation. This is true for many such positionals. They simply cannot be derived into adjective via $-VC_1$.

- (38) \sqrt{pa} 'standing'
 a. # $pa'apik$
 'very standing'
- (39) \sqrt{kotz} 'lying down (face up)'
 a. # $kotz'okik$
 'very lying down'

In addition to infelicity, though, there is a second pattern. With some non-gradable positionals the adjectival derivation triggers coercion. The positional becomes interpreted as partially gradable, like those in (16). The standard-raising effect of the positional adjective derivation can then target the new gradable component of the positional. The following examples illustrate this through a comparison of the stative and adjectival forms of the same positional root.

- (40) \sqrt{chak}
 a. $chakäl$ 'four-legged'
 b. $chakachik$ 'four-legged (and very big/strong)'
- (41) $\sqrt{tz'uy}$
 a. $tz'uyil$ 'seated'
 b. $tz'uyutz'ik$ 'seated (very unstable)'

While I do not believe it is possible to predict what kind of coercion we see with each positional, there are a few coercion types that repeatedly occur. In particular, in addition to the original physical configuration, a second gradable notion is added most commonly involving great size, precarity, brokenness, or wetness. The fact that we see coercion, while complicating, supports the underlying claim. If the positional is not associated with a scale, the positional adjective cannot have its effect. Felicity with such positionals then requires coercion.

Having shown that a positional must be scalar to smoothly take the positional adjective derivation, we can now consider whether some scales are more appropriate than others. What we will see is that it is generally felicitous with positionals that have open or lower closed scales, while it is infelicitous with positionals that have upper-closed scales.

First, consider positionals associate with open scales, namely scales for which there are no natural upper or lower bound. Such positionals are felicitous with the positional adjective derivation.

- (42) OPEN
- a. *b'uyub'ik* 'very soft', from $\sqrt{b'u}$ 'soft'
 - b. *kichikik* 'very messy', from \sqrt{kich} 'messy'
 - c. *jepejik* 'very short and fat', from $\sqrt{j\acute{e}p}$ 'short and fat'
 - d. *joröjik* 'very skinny', from $\sqrt{jör}$ 'skinny'

We know such positionals have open scales because they pass standard tests (Kennedy & McNally 2005: Sec. 3.2.4).¹² For instance, the standard interpretation of bounded scalar adjectives in the positive form is that the individual in question has the degree at the bound. This means that the negation of such an adjective should entail its antonym.¹³

This entailment does not hold for the positionals in (42), as in the following examples, which justifies calling them open-scale positionals.

- (43) Man \emptyset jor-öl ta, po man \emptyset ti'oj ta chuqa'.
 NEG A3S skinny-P.STAT IRR, but NEG A3S fat IRR also
 'He's not skinny, but he's not fat either.'

- (44) Man \emptyset kich-il ta, po man \emptyset nuk'-ül ta chuqa'.
 NEG A3S messy-P.STAT IRR, but NEG A3S tidy-P.STAT IRR also
 'It's not messy, but it's not tidy either.'

The positional adjective derivation is similarly grammatical with positionals associated with lower-closed scales, namely those for which there are minimum degrees of the property in question, but no maximum degrees.

- (45) LOWER CLOSED
- a. *ch'eqech'ik* 'soaking wet', from $\sqrt{ch'eq}$ 'wet'
 - b. *kotokik* 'very bent', from \sqrt{kot} 'bent'
 - c. *ch'emech'ik* 'very chipped', from $\sqrt{ch'em}$ 'chipped'
 - d. *ch'erech'ik* 'very sweaty', from $\sqrt{ch'er}$ 'sweaty'

Once again, we can show that such positionals are lower-closed through language internal tests. The positive form of such expressions should entail that an individual is mapped to non-zero degree on the scale. This means that its negation should contradict the assertion that the individual has the property to any degree. This is true for those positionals above, as exemplified in (46–47).

¹² Note that Kennedy & McNally (2005) primarily use the distribution of degree modifiers to diagnose scale structure, but Qaqchikel has a smaller inventory of such modifiers, and so it's not clear what semantic field the existing modifiers cover. For this reason, I have chosen to just use those tests from that work which are only dependent on features of Qaqchikel that we understand, like simple entailments, negation, conjunction, etc.

¹³ That is, an expression related to a lower-bounded scales like *bent* will always be true if an entity has positive measure on the relevant scale. Thus, its negation will require that any satisfying entity be at the lower bound—i.e., not bent. But then any such entity will be at the upper-bound for that expression's antonym—i.e., *straight*—and so will satisfy the antonym. This kind of reasoning does not hold for expressions related to scales without bounds—i.e., being not fat does not mean that an entity as at the minimal bound of fatness, and so must be skinny, because fatness/skinniness are not reckoned on a scale with a lower-/upper-bound.

- (46) #Man Ø ch'eq-ël ta w-aq'a', po k'o b'a ya' ch-r-ij.
 NEG A3S wet-P.STAT IRR E1S-hand, but exist little water PREP-E3S-back
 'My hands are not wet, but they got a little water on them.'
- (47) #Man Ø ch'em-ël ta, po jub'a x-Ø-pax el ru-chi'.
 NEG A3S chip-P.STAT IRR, po little CP-A3S-break DIR E3S-mouth
 'It isn't chipped, but its edge cracked a bit and fell off.'

Finally, while the positional adjective derivation is felicitous with positionals with open and lower-closed scales, we see the effect of scale structure with positionals associated with upper-closed scales. The positional adjective derivation is generally infelicitous with such expressions.¹⁴

- (49) UPPER CLOSED
- chol* 'straight', but # *choloçhik*
 - jäm* 'empty', but # *jamajik*
 - titz* 'shut and full', but # *titz'itik*
 - kaw* 'empty', # *kawakik*

As with the other cases, we can show that these positionals are, in fact, upper-closed, that is, denoting on a scale with maximal degrees. This is true, even though diagnosing upper-closed scales is known to be difficult due to the effects of imprecision. In general, though, gradable predicates with upper-closed scales have the default interpretation that an individual possesses the maximal degree on a scale (Kennedy 2007). This means that the positive form should be contradicted by asserting that an individual has any degree other than the maximum. Examples (50–51) show this to be the case.

- (50) Suppose your friend sells Güicoy. You go up to her, point at her basket, which happens to be covered, and say, "Can I have one?" She replies:
 #Jam-äl la chachäch la', po t-Ø-a-chap-a' el jun
 empty-P.STAT that basket there, but IMP-A3S-E2S-handle-SS DIR a
 aw-ik'oy.
 E2S-güicoy
 'That basket there is empty, but grab yourself a Güicoy.'
- (51) #Titz-İL ri costal ch-u-pan, po t-Ø-a-ya' más
 empty-P.STAT the bag PREP-E3S-inside, but IMP-A3S-E2S-give more
 ch-u-pan.
 PREP-E3S-inside
 'The bag is full of beans, but put more in.'

The clear contrast between upper-closed positionals and positionals with other scale types is a second, strong argument that positional roots are in fact scalar expressions. In the positive form, positionals require individuals to stand out relative to some standard.

¹⁴ As with the non-gradable positionals, while speakers certainly reject many upper-closed positionals with $-VC_1$, coercion is also possible here. The positional \sqrt{yun} 'shut (mouth)' is upper-closed, but under the $-VC_1$ derivation additionally includes the wrinkliness of the face, which is gradable.

- (48) Ø Yun-uy-ik ru-chi ri rij-iläj achin.
 A3S shut (mouth)-P.ADJ-SG E3S-mouth the old-SUP man
 'The old man's mouth was shut tight.'
 SPEAKER COMMENT: His mouth is shut tight and his face all wrinkled.

The positional adjective suffix requires this standard to shift upward. Like other degree morphology, the positional adjective derivation can be infelicitous depending on the scale structure of its positional argument. In particular, positionals with upper closed scales are generally infelicitous with the positional adjective derivation. This means that positional morphology is degree morphology and we should take positional roots to have a scalar semantics.

2.4 Beyond the *prima facie* gradable positionals

So far we have focused on those positionals that, according to their definitions in the corpus, lexicalize clearly gradable notions. This is the vast majority of positionals, but as noted at the beginning of this section, there are positionals that, at first pass, appear not to fit in this gradable category. I will propose a categorization in this section that allow us to fold some these positionals into the gradable category, while grouping others into a class with a scalar, though non-gradable semantics.

First, consider those positionals with what I called *partially gradable semantics*. These are positionals like $\sqrt{t\bar{a}r}$ ‘standing (broken)’ which have clearly gradable aspect to their meaning—i.e., broken—while having a second *prima facie* non-gradable aspect—i.e., standing. What we see is that, in general, these expressions behave like simple gradable positionals in constructions that we have argued have a gradable semantics. For instance, García Matzar & Rodríguez Guaján (1997: 335) says positional $\sqrt{t\bar{a}r}$ in its positional stative predicate form *taräl* characterizes things that standing and broken, while in the positional adjective form *taratik*, which I have argued has a standard-raising semantics, requires the individual be quite broken (lit. *bien quebrada*). This suggests that for the purposes of positional morphology, *partially gradable* positionals behave just like gradable positionals, but with the the degree expressions targeting the gradable aspect of their meaning.

We see a similar fact with the behavior of partially gradable positionals and comparatives. What is compared with these expressions is the gradable aspect of their meaning. For instance, given a root like $\sqrt{q\bar{e}b}$ ‘seated (fat)’, one can form comparative like (52).

- (52) Ri ak'wäl mas qeb'-äl chi-ki-wääch r-ach'alal.
 the child more seated(fat)-P.STAT PREP-e3p-front E3S-brother
 ‘The boy is fatter (seated) than his brothers.’

Fully understanding the lexical structure of these expressions with dual aspects to their meaning is still an open question, but the fact that these kinds of positionals can participate in degree constructions shows that we can treat them as scalar expressions just like those simple gradable positionals we have considered thus far.

While partially gradable positionals are fairly simple to deal with, the positionals with *prima facie* non-gradable semantics are more challenging. To begin, we do actually have evidence that these are not gradable. The previous section argued that the positional adjective form should be treated as standard-raising morphology. When we look at the 41 non-gradable and two-point scale positionals, the vast majority (33) do not occur in the positional adjective form. This suggests that they are, in fact, not gradable.¹⁵

Given that these positionals are, in fact, non-gradable, if they are to have a uniform scalar account, I must argue that they should involve reference to two-point scales. For

¹⁵ The exceptions are likely due to a combination of coercion, which we have seen allows for certain positionals with upper closed scales to be modified by the positional adjective, or the fact that translations can be misleading. For instance, the positional $\sqrt{p\bar{i}tz}$ is usually translated as ‘disemboweled’, which would be *prima facie* non-gradable, but if it is semantically more like ‘squished’, then this would explain why it occurs in the positional adjective form.

those positionals that I labeled *prima facie* non-gradable, it is clear that they lexicalize one end of a two-point scale in English (which is the primary diagnostic for such expressions). For instance, the positional \sqrt{sach} ‘lost’ lexicalizes one end of a scale that has *found* as its antonym. Among the remaining positionals that appear to be non-gradable, I believe that they can plausibly be treated as involving two-point scales. For instance, while we do not have robust intuitions about what the opposite of *red* or *circular* are, we do have strong intuitions certain states or configurations have salient opposites, even if they are not lexicalized. For instance, the root \sqrt{kup} ‘out of place’ is not gradable, and the language does not lexicalize an antonym meaning ‘in place’, but if we negate a stem based on the root, there is a salient “opposite” meaning, namely ‘in place’. We have similar intuitions for a roots like $\sqrt{b'oq}$ ‘torn off’, $\sqrt{k'uil}$ ‘married/joined’, \sqrt{xim} ‘tied up’, $\sqrt{tz'aj}$ ‘stuck (on something vertical)’ etc. In fact, the non-gradable roots generally lexicalize notions that have a salient opposite, if not a lexicalized antonym. For this reason, I will fold all of these positionals into single class with those I have labeled as two point scale positionals.

The result of these considerations is that as far as scalarity is concerned, there are two semantic classes of positions. On one hand, there are the gradable positionals and those simultaneously lexical two notions, one of which is gradable. These positionals behave as if they are related to multipoint scale of degrees that is accessible to various kind of degree operators. On the other hand, there is a small group of positionals (~ 40) that do not make reference to a multipoint scale, meaning they are not gradable. That said, we can treat these positionals as making reference to a scale with two degrees because they lexicalize a notion with a clear opposite.

2.5 Interim summary

This section has provided a set of arguments from various domains to argue that positional roots in Kaqchikel should receive a scalar semantics. We started by taking a broad look at the positional lexicon, showing that nearly all positional roots are *prima facie* gradable and that the gradable roots are more productive. After this, we saw that those *prima facie* gradable positionals do, in fact, behave like gradable expressions across languages. We saw that they freely occur in degree constructions like the comparative. Moreover, we saw that positional morphology, in this case $-\check{V}C_1$, can be degree morphology that is sensitive to scale structure. Finally, I have argued that those positionals that are not *prima facie* gradable can still be given a scalar account. Having produced evidence that positional roots require a scalar semantics, we will now provide precisely that kind of analysis. Moreover, we will show that the particular account we choose will explain the restricted distribution of positional roots in Kaqchikel, as well as shed light on the similarities and differences between positionals and gradable root adjectives, which also require a scalar semantics. The view we come to is that, semantically speaking, positionals are a kind of proto-adjective. They denote measure functions that positional morphology then derives into degree relations, the kind of expressions that gradable adjectives denote.

3 Positional roots are measure functions

In this section we extend the proposal three ways. First, we argue that the positional stative predicate derivation in (11a) is also degree morphology, though not an overt POS morpheme as it may at first appear. Second, we give a formal account of the positional stative derivation, as well as the positional adjective derivation described in the previous section. Finally, and more importantly, we argue for a formal account of positional roots themselves in which they denote measure functions—i.e., expressions of type $\langle e, d \rangle$. In this way, the Kaqchikel comes to be a case study in resolving a thorny issue for many languages, namely whether to treat gradable adjectives as measure functions or degree

relations of type $\langle d, et \rangle$. For instance, Kennedy & McNally (2005) note that English gradable adjectives can be treated as either type $\langle e, d \rangle$ or $\langle d, et \rangle$ to the same effect, and there appear to be no good semantic arguments to distinguish them. They note that crosslinguistically these two kinds of account will most likely only be distinguishable via (morpho)syntactic facts. This is exactly what we see in Kaqchikel, where their analysis suggests that positional roots are of type $\langle e, d \rangle$, while gradable adjectives have the relational type $\langle d, et \rangle$. To make this argument, though, we first have to better understand the positional stative predicate derivation.

The positional stative predicate form of positionals is their citation form. Not only is the positional stative predicate derivation the most productive, positionals thus derived have the widest syntactic distribution. The positional stative predicate derivation is illustrated in example (53).

- (53) a. \emptyset b'uy-ül.
 A3S soft-P.STAT
 'It's soft.'
- b. \emptyset chuk'-ül.
 A3S stiff-P.STAT
 'It's stiff.'

In simple non-verbal predicate constructions like (53), positionals receive a norm-related or evaluative reading. That is, they are satisfied by individuals that have a degree of some measure that exceeds some standard of comparison. This is clearly illustrated for open-scale positionals, where the standard is clearly context dependent, just as with the positive form adjectives in English.

- (54) Suppose your friend says she bought a pencil on the bus for Q20.
 \emptyset Jot-öl r-ajil.
 A3S elevated-P.STAT E3S-price
 'That's expensive.'

- (55) Suppose your friend says she bought a silk shawl on the bus for Q20.
 # \emptyset Jot-öl r-ajil.
 A3S elevated-P.STAT E3S-price
 'That's expensive.'

If positional stative predicates can have evaluative semantics, could $-\ddot{V}l$ be the morphological instantiation of POS in Kaqchikel? Consider what that would entail. If we take position roots to denote measure functions, as we will argue for in detail below, then $-\ddot{V}l$ would have the translation in (57). It would take a measure and predicate of individuals that is true of an individual, just in case the individual's degree on the measure in question exceeds the contextual standard.

- (56) $jot \rightsquigarrow \lambda x[\text{HIGH}_{ed}(x)]$

- (57) Kennedy (1999)
 $-\ddot{V}l \rightsquigarrow \lambda m \lambda x[m(x) \geq s(m)]$ POS

While this describes the truth conditions of expressions like (53), there are problems with an account of $-\ddot{V}l$ as POS.

First, it incorrectly predicates that positional stative predicates should not be able to be the target of further degree modification. Example (58–59) show that positional stative predicates do allow further degree modification, which should not be possible if $-\check{V}l$ were POS, which derives predicates of individuals with no exposed degree argument.¹⁶

- (58) a. Yalan \emptyset jot-öl r-ajil.
 very A3S elevated-P.STAT E3S-price
 ‘It’s very expensive.’
 b. Yalan \emptyset tew.
 very A3S cold
 ‘It’s very cold.’
- (59) a. Jub’a \emptyset jot-öl r-ajil.
 little A3S elevated-P.STAT E3S-price
 ‘It’s a little expensive.’
 b. Jub’a \emptyset tew.
 little A3S cold
 ‘It’s a little cold.’

A second related problem is that positional stative predicates, like underived adjectives, can appear in the comparative. More importantly, these comparatives are acceptable in crisp-judgment contexts, which is not expected if they have a POS-like semantics.

- (60) Suppose you’re trying to help a friend decide which pencil to buy.
 The red one is a few cents more than the blue one. Can you say:
 a. Ri kăq (mas) jot-öl r-ajil ch-u-wäch ri xar.
 the red (mas) **elevated**-P.STAT E3S-price P-E3S-face the blue
 ‘The red is more expensive than the blue.’
 lit. ‘The red one’s price is higher than the blue one’s.’
- (61) Suppose there two boys, twins, but one is one centimeter taller
 than the other. Can you say:
 a. Ri jun ala’ (mas) **nim** r-aqan ch-u-wäch ri jun chik.
 the one boy (mas) **big** E3S-leg P-E3S-face the one other
 ‘The one boy is taller than the other.’
 lit. ‘The one boy’s leg is bigger than the other one’s.’

Instead, the data show that positionals derived by $-\check{V}l$ do not denote simple predicates of individuals, but still have an exposed degree argument that can be targeted by conditionals and other degree morphology, including POS itself. If $-\check{V}l$ is not POS, then, what is its function? I argue that it is degree morphology, just like the positional adjective derivation. Its semantic function is different, though. I will argue that it merely takes measure functions of type $\langle e, d \rangle$ into degree relations of type $\langle d, et \rangle$, which I argue is the type of

¹⁶ While we have assumed that gradable expressions require a degree-based analysis, a Kleinian account of gradable is still an open possibility (Klein 1982). The goal of this paper is not argue for or against degree-based analyses in general, but it is important to note that while a Kleinian account could deal with degree modifiers like in (58–59), the fact that Kaqchikel has bounded gradable expressions that support crisp judgments, like (60–61), is more problematic for an alternative Kleinian analysis which would treat such expressions as vague predicates.

gradable adjectives in Kaqchikel. In essence, the $-\ddot{V}l$ derivation will give positionals adjective denotations, but with non-adjectival morphosyntax. This account, developed formally in the following section, will explain why positionals require derivation, but once derived have a similar distribution to gradable adjective, modulo the fact that they have a verb-like syntactic distribution.

3.1 The formal account

In developing the formal account we focus on two two generalizations. First, positionals cannot be used underived (unlike expressions of any other root class). Second, if a (predicative) adjective can occur in a degree construction, a positional derived by $-\ddot{V}l$ can appear there too. We will see that these generalizations can be accounted for if (i) positional roots denote measures of type $\langle e, d \rangle$, meaning they are not predicates and their degree argument is not exposed, and (ii) $-\ddot{V}l$ derives measures into relations of type $\langle d, et \rangle$, which is the same type as root gradable adjectives.

First, consider a standard account of gradable adjectives with evaluative semantics in simple predicational constructions (e.g., Cresswell 1977; von Stechow 1984; Heim 2000; Schwarzschild 2005). Adjectives denote degree relations, like (62), while POS saturates the degree argument, as in (63–64).¹⁷

$$(62) \quad \sqrt{s\ddot{a}q} \rightsquigarrow \lambda d \lambda x [\text{WHITE}_{\langle ed \rangle}(x) \geq d]$$

$$(63) \quad \text{POS} \rightsquigarrow \lambda g_{\langle d, et \rangle} \lambda x \exists d [g(d)(x) \wedge d \geq s(g)]$$

$$(64) \quad \sqrt{s\ddot{a}q}\text{-POS} \lambda x \exists d [\text{WHITE}_{\langle ed \rangle}(x) \geq d \wedge d \geq s(T(\sqrt{s\ddot{a}q}))]$$
¹⁸

The result of derivation by POS in (64) is a predicate of individuals that is true of an individual x just in case x 's degree of whiteness is at least d and d is greater than the standard for whiteness in the context. These are precisely the truth conditions of expressions like (65) in Kaqchikel.

$$(65) \quad \emptyset \quad s\ddot{a}q.
A3S \text{ white}
'It's white.'$$

Turning to positionals, the core proposal is that they denote measure functions, as in (66). Here, the positional root \sqrt{jot} 'high', is translated as a function that takes an individual and returns a degree measuring its height.

$$(66) \quad \sqrt{jot} \rightsquigarrow \lambda x [\text{HIGH}_{ed}(x)]$$

One function of positional morphology, then, is to turn measure functions into bona fide relations, that is, expressions that evaluate to truth values. In the case of the positional stative predicate derivation $-\ddot{V}l$, I propose that it derives positional roots into expressions that are structurally equivalent to root adjectives. This effect is shown in (68), which looks exactly like (62) modulo the measure function at its core.

¹⁷ The particular formulation of POS presented here is not critical for the analysis. Any treatment of POS that takes an expression of type $\langle d, et \rangle$ and sets the contextual standard based on the denotation of that expression could be consistently substituted.

¹⁸ Note here that to save space, instead of reproducing the translation of (62), I pass to the standard-setting function the translation of $\sqrt{s\ddot{a}q}$ —written as $T(\sqrt{s\ddot{a}q})$.

$$(67) \quad -\ddot{V}l \rightsquigarrow \lambda m_{ed} \lambda x \lambda d [m(x) \geq d]$$

$$(68) \quad \sqrt{jot-öl} \rightsquigarrow \lambda d \lambda x [\text{HIGH}_{ed}(x) \geq d]$$

Because $\ddot{V}l$ -derived positionals are semantically equivalent with root adjectives, they can compose with POS, as in (69).

$$(69) \quad \sqrt{jot-öl-POS} \rightsquigarrow \lambda x \exists d [\text{HIGH}_{ed}(x) \wedge d \geq s(\text{T}(jotöl))]$$

The result is a predicate of individuals that is true of an x just in case the degree measuring x 's height is at least d and d is greater than the standard for height in the context. These are the truth conditions of the positional stative predicate in (70).

$$(70) \quad \emptyset \quad \text{jot-öl.}$$

A3S high-P.STAT
'It's high.'

Note that while I have illustrated the interaction of POS and $-\ddot{V}l$ with a gradable positional \sqrt{jot} , the account works just as well for positionals associated with two point scales. In particular, such a positional will denote a measure that takes individuals to one of two degrees. The $-\ddot{V}l$ morpheme will take such a measure into a relation between individuals and those to degrees that holds just in case the individual exceeds the standard. Finally, POS fixes the standard so that only individuals mapped to the degree higher on the scale. Essentially, these positionals behave exactly as if they were associated with upper closed scales, except that they are not gradable in virtue of having only two degrees.

Taking a broad view, the core claim of the analysis is that positional roots are a kind of proto-adjective. They denote expressions that can be explicitly derived into expressions that denote just as root adjectives do. Beyond getting the truth conditions of root adjectives and positional stative predicates in evaluative contexts, this type of account makes a series of correct predictions about the similarities and differences between positionals and adjectives.

First, the analysis explains the core generalization that positionals are unique in needing derivation, as shown in (71). Positionals cannot be used undervived because they are not predicates—type $\langle et \rangle$. The positional root in (71) maps its argument to a degree, not a truth value, and so (71) is unassertable.

$$(71) \quad * \emptyset \quad \text{jot} \quad \text{r-ajil.}$$

A3S high E3S-price
'It's expensive.'

Note that unlike with root adjectives, the phonologically null POS morpheme cannot help because it is of the wrong type, as shown in (72).

$$(72) \quad * \text{POS}_{\langle (d, et), et \rangle} (\text{HIGH}_{ed})$$

The only way for POS to compose with a positional is for it to first compose with an expression like $-\ddot{V}l$ above, which produces an degree relation of type tuple_{ed}, et .

A second argument in favor of this type difference works in the opposite direction. While positional roots cannot compose with degree morphology specialized for root gradable adjectives, positional degree morphology cannot compose with adjectives. This is surprising given that it is simple degree morphology. Example (73) illustrates that the

derivational degree modifier $-VC_1$ we encountered in the previous section cannot target adjectives.¹⁹

(73) **saq-as-ik*
white-P.ADJ-SG

(74) * $-VC_{\langle ed, \langle d, et \rangle \rangle} (SAQ_{\langle d, et \rangle})$

At the level of the root, then, the analysis makes correct predictions about the differences between adjectives and positionals, even though both have a scalar semantics. The analysis also makes correct predictions about similarities between root adjectives and derived positionals, in particular, positionals in the positional stative predicate form. The analysis claims that while positional stative predicates are morphosyntactically different than bona fide adjectives, they have the same denotations. We correctly predict that they should occur in the same degree constructions. We see in examples (58–59) that both positionals and adjectives alike accept the same degree modifiers once the former has been derived.

(75) a. *Yalan* \emptyset **ch'eq-ël.**
very A3S wet-P.STAT
'It's very wet.'

b. *Yalan* \emptyset **tew.**
very A3S cold
'It's very cold.'

(76) a. *Jub'a* \emptyset **jot-öl** *r-ajil.*
little A3S elevated-P.STAT E3S-price
'It's a little expensive.'

b. *Jub'a* \emptyset **k'äy.**
little A3S bitter
'It's a little bitter.'

Also note that both adjectives and derived positionals freely occur in the comparative (e.g., 60–61). The fact that derived positionals can appear in a similar range of degree constructions as root adjectives supports the proposal that positionals have a scalar semantics and are derived into expressions of the same type as root gradable adjectives.

A final argument in favor of the particular type-theoretic account of positionals developed here concerns overt measure arguments. In all the examples we have seen thus far, the positionals have their the degree argument targeted, though not overtly satisfied. Examples like (77) show that $\check{V}l$ -derived positionals have exactly the type structure the proposal predicts.

(77) *Ju-jaj* *jot-öl* *nu-ch'akät chi kaj.*
one-arm.length elevated-P.STAT E1S-chair P heaven
'My chair is one arm-length tall in height.'

The derived positional is of type $\langle d, et \rangle$, expecting a degree argument first. This is supplied by *jujaj*, which denotes degrees that measure one arm's length. This saturates the degree

¹⁹ Note that an analysis of the $-VC_1$ derivation comes at the end of the section, though for now note that we will treat it as having the same type as the $\check{V}l$ positional stative predicate derivation, namely $\langle ed, \langle d, et \rangle \rangle$.

argument of *jotöl* as in (78), generating a predicate of individuals who measure on the height scale is greater than an arm-length.

$$(78) \quad \text{jujaj jotöl} \rightsquigarrow \lambda x[\text{HIGH}_{(ed)}(x) \geq d_{\text{ARM-LENGTH}}]$$

Example (77) thus asserts that the speaker's chair satisfies the predicate in (78), namely it is one arm-length tall, which are the correct truth conditions. More importantly for the argument here, constituency accords with the predicted type for positional stative predicates.²⁰ They are, in fact, degree relations that compose first with a degree argument and then an individual argument to return a truth value.

The behavior of positional roots and their derived counterparts support the core analysis here. Positional root denote measure functions, while positional morphology derives positional stems that denote relations. We have seen how this works for the positional stative predicate derivation $-\check{V}l$. I now want to return to the standard-raising positional derivation $-VC_1$ that the previous section showed to be degree morphology. We will see that $-VC_1$ has the same type as $-\check{V}l$, but with a standard-raising semantic effect.

Recall the two major generalizations concerning the positional adjective derivation $-VC_1$. First, $-VC_1$ is standard-raising morphology. Second, positional roots with upper-closed scales reject $-VC_1$ derivation. This suggests the following analysis that I will develop here. Standard raising by $-VC_1$ requires the an individual to exceed in measure, not just the contextual standard on the scale at issue, but all contextual relevant degrees on the scale. Now, if the upper bound is always contextually salient for upper-closed positionals, then $-VC_1$ would derive for these positional predicates of individuals who are off the scale, which should be infelicitous.

We have already seen that the second crucial ingredient of the analysis holds in Kaqchikel. Just like in English, positionals with upper closed scales do in fact take the maximal degree to be the standard in the positive form (see examples 50–51). This shows that the upper-bound for upper-closed positionals is, in fact, by default contextually salient. Kennedy (2007), for instance, predicts this to be the case via a pragmatic principle of INTERPRETIVE ECONOMY, which says that by default, if setting the contextual parameters for *pos* can be done using only the conventional meaning of the expressions involved, it will be. Having observed this though, we can hard code it into our standard POS operator for simplicity, keeping in mind that this is merely an expository shortcut. The crucial clause for understanding $-VC_1$ is that upper-closed positionals in the positive form will require satisfying individuals to have the maximal degree on the scale by default.

$$(80) \quad \text{POS} \rightsquigarrow \lambda g \lambda x \exists d [g(d)(x) \wedge d \geq s(g)], \text{ where}$$

- a. $s(g) = \mathbf{max}(g)$, if g has an upper-closed scale
- b. $s(g) = \mathbf{min}(g)$, if g has a lower-closed scale
- c. $s(g) =$ the contextual standard for g , if g has a fully open scale

²⁰ We know that *jujaj jotöl* plausibly forms a constituent and that *jujaj* is not some higher adverbial because usually stative subjects can prepose to a position in front of the stative predicate, but before higher adverbials. This is completely impossible with measures, as shown below. Instead the only possible preposing moves the subject over both measure and stative predicate, which suggests they form a stative predicate together.

- (79) a. *Ju-jaj nu-ch'akät jot-öl chi kaj.
 one-arm.length E1S-chair elevated-P.STAT P heaven
 'My chair is one arm-length tall in height.'
- b. Nu-ch'akät ju-jaj jot-öl chi kaj.
 E1S-chair one-arm.length elevated-P.STAT P heaven
 'My chair is one arm-length tall in height.'

We can now turn to the standard-raising effect of $-VC_1$, which will interact with the default interpretation of POS for upper-closed position to generate infelicity. I borrow an idea from the account of extreme adjectives—*gigantic*, *fantastic*, *gorgeous*, etc.—due to Morzycki (2012). In addition to contextually specified standard degrees, there is also a set C of salient degrees that act as domain restriction for degree quantification. For instance, for a domain-restricted version of POS above, we would simply require that $d \in C$ in addition to satisfying the degree relation and being greater than the contextual standard (that would also be in C). My proposal for the semantic effect of $-VC_1$ is that it targets the domain restriction, further restricting quantification by picking out just those degrees that are greater than every degree in C .

$$(81) \quad -VC_1 \rightsquigarrow \lambda m \lambda d \lambda x [d > \mathbf{max}(C) \wedge m(x) = d]$$

First, note that this analysis accounts for the fact that VC_1 -derived positionals are indeed standard-raising. We know that any contextual standard, by definition, must be in C . The $-VC_1$ derivation derives a relation between degrees and individuals that holds just in case the individual's degree exceeds the maximum standard allowed in the context. Essentially, the $-VC_1$ derivation says that an individual doesn't just exceed the standard, but exceeds the range from which standards are chosen. It is standard-raising in this sense.

Second, the analysis says that the type of the VC_1 -derivation is exactly the same as the $-\check{V}I$ positional stative predicate derivation. This is important because it correctly predicts that these derived positional adjectives, in virtue of having an unsaturated degree argument, should be able to appear in a similar range of degree constructions as the positional stative predicate. This is illustrated for the comparative construction in (82).

$$(82) \quad \text{In (mas) ch'eq-ech-ik ch-u-wäch rija'}$$

A1S (mas) wet-P.ADJ-SG P-E3S-face PRO.3S
'I'm more soaked than him.'

Most importantly, though, the account now predicts the infelicity of the positional adjective derivation with positionals associated with upper-closed scales.²¹ First, for comparison though, let's consider the behavior of $-VC_1$ with a positional that it can felicitously compose with. In (83) we see such a positional, which happens to be lower-closed.

$$(83) \quad \emptyset \text{ ch'eq-ech-ik.}$$

A3S wet-P.ADJ-SG
'It's very wet.'

We assume that in non-verbal predicate constructions like (83), the positional adjective also composes with POS, just as with the positional stative predicate constructions above. The result is the predicate in (84), which is true of an individual x just in case x is at least d -wet and d is not only greater than the contextual standard for wetness (namely the lower bound as given by 80), but d is greater than every contextually salient degree of wetness. That is, x is very wet, which are the truth conditions of the predicate in (83).

$$(84) \quad \text{ch'eqech-ik-POS} \rightsquigarrow \lambda x \exists d [d > \mathbf{max}(C) \wedge \text{WET}(x) \geq d \wedge d \geq \mathbf{min}(\text{WET})]$$

²¹ Note that this includes those positionals that with two point scales, which are by definition upper-closed, and which do not generally have positional adjective forms.

With upper-closed scales, in contrast, the standard defaults to the maximum degree. This causes immediate problems. Consider what happens with the unattested (85).

- (85) # \emptyset jam-aj-ik
 A3s empty-P.ADJ-SG
 READING SOUGHT: ‘It’s very empty.’

Example (86) shows the predicate derived by $-VC_1$.

- (86) jamajik-POS \rightsquigarrow
 $\lambda x \exists d [d > \mathbf{max}(C) \wedge \mathbf{EMPTY}(x) \geq d \wedge d \geq \mathbf{max}(\mathbf{EMPTY})]$

It is true of an individual x just in case it is d -empty and d is not just greater than the context standard, but greater than all salient degrees of empty. With upper-closed scales, though, the greatest degree on the scale is the contextual standard, and thus in C . But now $-VC_1$ will only be true of individuals who have a degree greater than any in C , which is impossible because there is no such degree. That is, x must be more empty than completely empty, which should be infelicitous.

While there is certainly more to explore, both for the positional adjective derivation and the positional stative predicate derivation, we have seen here that positional specific morphology can be given scalar semantics that captures both their truth conditions and compositional structure. The latter has played an especially important role in explaining the distribution of positional roots and stems. The core idea throughout has been that positional roots denote measure functions, while derived positionals denote degree relations of the same type as root adjectives. This explains the fact that positional roots are extremely constrained, while the positional stems considered here have a similar distribution to root adjectives across a variety of degree constructions.

3.2 Against a purely morphosyntactic account

In the previous section I argued that the distribution of positional roots and their derived stems was most directly constrained by semantics, in particular, by types. Positional roots denote measure functions, while positional morphology takes such functions into degree relations. There are alternatives, though, to a semantics-centric account. The skeptic might say that instead of types, positional roots are constrained due to their syntactic category. For instance, Evans & Levinson (2009), who argue that positionals roots belong to a novel lexical category P , could say that positionals require overt derivation into another lexical category because only those categories have inflection. Alternatively, a Distributed Morphology approach might say that positional roots are category-less, and with no zero derivation, require overt category-defining morphology to be inflected.

I will argue against both of these syntactic alternatives at once. In particular, I argue that positional roots are neither category-less nor have a boutique category, but instead are verbal roots with the category V .²² Moreover, I argue that $-\check{V}$ is not category-changing, so

²² In recent work, Coon (2019) defends the idea that verbal roots in Mayan, namely intransitive and transitive roots are distinguished in being of type $\langle e, st \rangle$, where s ranges over eventualities. That is, verbs take an internal argument and produce a predicate of eventualities. There is some tension between this proposal and the one here because I argue that positional roots are verbal but, crucially, they must be measure functions and not be relations of this type. There is reason to believe, though, that gradable adjectives might require both event- and state-type arguments (e.g., Wellwood 2015; 2016). There is not enough space here to consider whether positionals require an eventuality argument, though I expect so. If we take this route, then positional roots become even closer semantically to verb roots, as proposed by Coon (2019). In this case, positionals would just be defective verb roots, taking both an individual and eventuality argument, as Coon (2019) proposes, but relating it to a degree, not a truth value.

Ÿl-marked positionals are of category V as well. Thus, category membership alone can't constrain the distribution of positionals, and so the semantic explanation advocated here is better.

The primary argument that positional roots are verbal concerns those expressions they share derivations with. In particular, while there are positional-specific derivations, positional roots only share derivation with verb roots. Consider the instrumental nominalization, which is productive with verbs roots, as in (87), but not roots of other core categories like adjectives or nouns, exemplified in (88).²³

(87) Verbal instrumental nominalization

- a. **paj**-b'äl
measure-INSTR
'measuring instrument'
- b. **war**-b'äl
sleep-INSTR
'sleeping place'

(88) Adjective/Noun instrumental nominalization

- a. **#tzay**-b'äl
salty-INSTR
READING SOUGHT: 'salt shaker'/'salty place'
- b. **#wuj**-b'äl
book-INSTR
READING SOUGHT: 'book store'

When we turn to positionals we see that they behave like verb roots, but not roots of other categories, in allowing instrumental nominalization.

(89) Positional instrumental nominalization

- a. **weq**-b'äl
adorned-INSTR
'adornments'
- b. **tzuy**-b'äl
seated-INSTR
'seat'

The fact that positional roots share derivations with verb roots is not a parochial fact about Kaqchikel. Across the Mayan family positionals share affinities with verbs. For instance, in Chol, positional intransitive derivation is the same as the passive for a subset of transitive verbs (Coon & Preminger 2009). Similarly, Tzotzil has a construction, called Color + Positional Compounds, which applies productively, only to positional and verb roots (Laughlin 1975; Haviland 2003). These considerations suggest a deep historical connection between verb and positional roots that we see synchronically in Kaqchikel in patterns like (87–89). The best explanation is that positional roots are just verb roots, though a distinguished subclass with some of its own morphology to manage their degree denotations, as argued here. The idea is that just like transitive and intransitive roots form morphologically distinguishable root class, yet are both verbal in virtue of also sharing a number of derivations, positional roots would be a third distinct verbal root class.

²³ While traditionally called an instrumental derivation in the Mayan literature, nouns derived by *-b'äl* can also denote locations where some event takes place.

If we accept, then, that positional roots have the category *V* in virtue of sharing derivation with verbs, we can further show that $-\check{V}l$ is not category changing. Positional stative predicates derived by $-\check{V}l$ share derivations with verbs, but not other categories. Consider, for instance, gerundive nominalization by affix $-en$. The examples in (90) show bona fide verbs roots being nominalized by the $-en$ suffix, while the examples in (91) show positional stative predicates being derived by the same morpheme.

(90) Verb nominalization

- a. **qaj-en**
lower-NOM
'lowering'
- b. **war-en**
sleep-NOM
'sleeping'

(91) $\check{V}l$ nominalization

- a. **jot-ol-en**
high-P.STAT-NOM
'height'
- b. **tzuy-ul-en**
sit-P.STAT-NOM
'sitting'

(92) Adjective nominalization

- a. **#kaq-en**
red-NOM
READING SOUGHT: 'redness'
- b. **#nim-en**
big-NOM
READING SOUGHT: 'bigness'

Crucially, expressions of other categories, even categories with an allied semantics like adjectives, reject derivation by $-en$. This shows that $\check{V}l$ -derived positionals, in virtue of taking verbal derivations, have the category *V*.

In sum, the morphological evidence shows that positional roots are of category *V*. Moreover, $\check{V}l$ -derived positionals are also of category *V*. Thus, a purely syntactic account of why underived positionals cannot occur in degree constructions faces obstacles. We cannot say that positional roots, unlike roots of any other type in the language, cannot appear because they have a boutique category or no category at all. This bolsters the semantic account proposed in this previous sections. Positional roots denote measure functions, which simply cannot be used as predicates. They require derivation in order to denote an expression that can take both an individual and degree argument to return a truth value.

4 Conclusions

Over the course of this paper three major claims have been made. First, I have argued that positionals in Kaqchikel should receive a scalar semantics. Their distribution and semantic properties closely follow gradable adjectives in English, as well as such adjectives in Kaqchikel itself. Second, I have argued positional roots are of a different type than gradable root adjectives in Kaqchikel and that positional morphology serves, in part, to

bestow positional stems with the same type as gradable adjectives. Finally, I argued that the reason positionals are the only root class that must be derived follows from these previous two claims. In particular, as expressions of type $\langle ed \rangle$, positional roots are not relational, and so must be derived into an expression of the appropriate type to be used. In addition to making this positive semantic argument, I have argued here against syntactic alternatives in which positional roots are category-less or have a boutique syntactic category.

While this work is empirically focused on the proper analysis of positionals in Kaqchikel, there are wider theoretical points this work addresses. First, this work weighs in on the important question of whether languages can have lexical categories beyond the familiar verb, noun, adjective, adverb. At first pass, positionals look like a good case of a novel lexical category, and this has even been argued (Evans & Levinson 2009). I have shown here that this is not the case. Morphosyntactically, positionals are just verbs, but have a unique distribution in virtue of their lexical semantics and semantic type. This result emphasizes the need for analytical depth when we want to make claims about lexical categories. Fairly abstract notions, like semantic type, can constrain surface morphosyntactic distributions in ways that may be misleading. The second major theoretical result of this work is that it confirms a prediction by Kennedy (2007), namely that languages may differ in whether degree expressions have type $\langle ed \rangle$ or type $\langle d, et \rangle$, and that this difference is most likely only distinguishable (morpho)syntactically. We have shown here that even in the same language we can see such a split in degree-denoting expressions, and the split can be diagnosed syntactically.

Finally, because this work provides the first detailed formal analysis of positionals in any Mayan language, it has only been possible to scratch the surface of what there is to explore. I see three areas for future work that are especially pressing. To begin, it is critical to being to explore how well this analysis presented here extends to other Mayan languages. I strongly expect it to hold for the K'ichean-branch languages, but from browsing dictionaries and grammars, it may be the case that positionals in some western-branch Mayan languages have a more verb-like lexical semantics than the adjective-like notions lexicalized in Kaqchikel. This does not necessarily preclude a scalar account; there are many scalar change verbs in languages like English, for instance, work must be done to see how well the account extends to these languages.

A second area that requires further exploration concerns the facts raised in footnote 11. For some positionals, varying by speaker, the positional adjective derivation prefers an individual-level reading that does not have a standard-raising flavor. This fact does not negate the need for a standard-raising account of $-VC_1$ for many positionals, nor does it preclude a degree-based account of these non-standard-raising individual-level readings. In fact, these readings can be handled assigning $-VC_1$ a degree denotation similar to $-\check{V}l$, but restricted to individual- and not stage-level predication. The outstanding work is to understand which positionals can have this individual-level reading, and to tie it to some deeper lexical-semantic fact.

A final avenue for future work should explore deeper reasons why some notions are lexicalized as positionals, while other are lexicalized as adjectives, and whether any such difference could explain the type differences I have proposed here. In particular, when we look at Kaqchikel root adjectives, almost all of them are so-called relative adjectives—they are related to scales that have no upper or lower bound. It would be nice to be able to say adjectives have the type they do, in contrast to positionals, in virtue of lexicalizing this particular class of gradable notions, though the way forward to addressing this problem is not clear.

Abbreviations

1 = first person, 2 = second person, 3 = third person, A = absolutive, ABST = abstractivizing, CAUS = causative, CLF = classifier, CP = completive aspect, DIR = directional, E = ergative, IMP = imperative, INCH = inchoative, IRR = irrealis, NEG = negation, NOM = nominalization, PREP = preposition, P = plural person, PAS = passive, PDIST = pluractional distributive, PL = plural, P.ADJ = positional adjective, P.ITV = positional intransitive, S = singular person, P.STAT = positional stative predicate, SUP = superlative

Additional File

The additional file for this article can be found as follows:

- **Appendix.** Kaqchikel Positional Roots. DOI: <https://doi.org/10.5334/gjgl.515.s1>

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