A Delineation Solution to the Puzzles of Absolute Adjectives

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Abstract

The paper presents both new data and a new analysis of the semantic and pragmatic properties of the class of **absolute scalar adjectives** (ex. *dry, wet, straight, bent, flat, empty, full...*) within an extension of a well-known logical framework for the analysis of gradable predicates: the **delineation semantics framework** (*DelS*) (see Klein, 1980; van Benthem, 1982; van Rooij, 2011b, among many others). It has been long observed that the context-sensitivity, vagueness and gradability features of absolute scalar predicates give rise to certain puzzles for their analysis within most, if not all, modern formal semantic frameworks. While there exist proposals for solving these puzzles within other major frameworks (such as the **degree semantics framework**), it has been argued that some of their aspects are particularly challenging for the analysis of absolute scalar predicates within the delineation approach. By combining insights into the relationship between context-sensitivity and scalarity from the *DelS* framework with insights into the relationship between tolerance/similarity relations and the Sorites paradox from Cobreros et al.'s 2012 *Tolerant, Classical, Strict* (TCS) framework, I propose a new logical system, called *Delineation TCS* (DelTCS), in which to set analyses of four classes of adjectival predicates. I argue that this new framework allows for an analysis of absolute scalar adjectives that answers these challenges for delineation-based frameworks, while still preserving the heart of Klein-ian approach.

1 Introduction

The paper presents both new data and a new analysis of the semantic and pragmatic properties of the class of **absolute scalar adjectives** (henceforth *AA*s (1)) within an extension of a well-known logical framework for the analysis of gradable predicates: the **delineation semantics framework**, henceforth *DelS* (see McConnell-Ginet, 1973; Kamp, 1975; Klein, 1980; van Benthem, 1982; Keenan and Faltz, 1985; Larson, 1988, among many others).

(1) **Absolute Scalar Adjectives** (AAs):
dry, wet, straight, crooked, bent, flat, smooth, empty, full, open, closed, healthy, safe, dangerous, awake, opaque, transparent...

Based on both well-known and novel empirical observations, I argue that adjectives such as those in (1) can be distinguished from two other lexical classes of adjectives, *relative scalar adjectives* (RAs (2)) and *non-scalar adjectives* (NSs (3)), along three separate dimensions:

1) **their context-sensitivity**, i.e. how their criteria of application can vary depending on context; 2) **their vagueness**, i.e. how they display the characteristic properties of vague language (to be discussed below); and 3) **their scale structure**, i.e. what the properties of their associated orders (a.k.a. *scales*[1]) are.

(2) **Relative Scalar Adjectives (RAs):**
tall, short, expensive, friendly, narrow, wide...

(3) **Non-Scalar Adjectives (NSs):**
atomic, geographical, polka-dotted, dead, hexagonal...

It has been long observed that the context-sensitivity, vagueness and gradability features of absolute scalar predicates give rise to certain puzzles for their analysis within most, if not all, modern formal semantic frameworks. While there exist proposals for solving these puzzles within other major frameworks (see, for example, those proposed in the *degree semantics* framework by Rotstein and Winter, 2004; Kennedy and McNally, 2005; Kennedy, 2007; McNally, 2011, among others), it has been argued (by Kennedy, McNally and van Rooij, 2011c, among others) that some aspects of these puzzles are particularly challenging for the analysis of AAs within a delineation approach to the semantics of gradable predicates. In particular, as we will see below, delineation semantics frameworks are characterized by proposing the existence of an exceptionally close relationship between context-sensitivity and gradability, and, by virtue of this relationship, the semantic and pragmatic properties of AAs appear to create certain paradoxes for DelS systems. By combining insights into the relationship between context-sensitivity and gradability from the *DelS* framework with insights into the relationship between tolerance/similarity relations and the Sorites paradox from Cobreros et al.'s 2012 *Tolerant, Classical, Strict* (TCS) framework, I propose a new logical system, called *Delineation TCS* (DelTCS), in which I develop analyses of AAs, RAs and NSs. I then argue that this new framework allows for an analysis of absolute scalar predicates that answers these challenges for delineation frameworks, while still preserving the heart of this context-sensitivity-based approach.

The article is organized as follows: in section 2, I present the context-sensitivity, vagueness and scale structure properties of AAs and outline how they differ from those of RAs on the one hand and NSs on the other. Then, in section 3, I outline a (simplified) version of Klein's 1980 DelS system and show how this system can be used to give an analysis of the gradability and context-sensitivity properties of relative scalar adjectives along the lines of van Benthem (1982). I then present a previous delineation analysis of AAs, that of van Rooij (2011c), and I argue that, while the analysis manages to account for some of the puzzling properties of AAs, others remain. Therefore, in section 4, I extend the basic delineation system described in section 3 with a *TCS* approach to the analysis of vague language to create the *DelTCS* logical framework, and I argue this new framework both allows for a comprehensive and elegant solution to the challenges that AAs pose for the delineation framework and provides a broad and general perspective on the analytical relationships between context-sensitivity, vagueness and scalarity that exist in natural language.

[1]Note that, in this paper, I use the term *scales* to refer to the orderings associated with gradable predicates regardless of what the strength of these orderings are, i.e. whether or not they are total 'degree' orderings as is often proposed in Degree Semantics.

2 The Puzzling Properties of Absolute Adjectives

It has been observed since at least Sapir (1944) that the syntactic category of bare adjective phrases can be divided into two principal classes: *scalar* (or *gradable*) vs *non-scalar* (*non-gradable*). The principal test for scalarity of an adjective P is the possibility of P to appear in the explicit comparative construction (or other degree constructions). Thus, we find a first distinction between scalar adjectives like *tall, expensive, wet*, and *empty* (4), which are associated with articulated orderings, on the one hand, and adjectives like *atomic, pregnant* and *geographical*, which are not associated with such orderings, on the other (5)[2].

(4) a. John is taller than Phil, who is taller than Mary.
b. This towel is wetter than that towel, which is wetter than this third towel.
c. My cup is emptier than your cup, which is emptier than John's cup.

(5) a. ?This algebra is more atomic than that one.
b. ?This shape is more hexagonal than that one.

Since Unger (1975), it is common to propose the further division of the class of scalar adjectives into two subclasses: what are often called the *relative* class and the *absolute* class. The first way in which these two classes can be distinguished concerns their context-sensitivity properties. As observed by e.g. Kyburg and Morreau (2000) and Kennedy (2007), and investigated from an experimental perspective by Syrett et al. (2006), Syrett et al. (2010), and Foppolo and Panzeri (2011), adjectives like *tall* and *empty* differ in whether they can 'shift' their thresholds (i.e. their criteria of application) to distinguish between two individuals in a two-element comparison class when they appear in a definite description (this paradigm is known in the literature as the **definite description test**). For example, suppose there are two containers (A and B), and neither of them are particularly tall; however, A is (noticeably) taller than B. In this situation, if someone asks me (6-a), then it is very clear that I should pass A. Now suppose that container A has less liquid than container B, but neither container is particularly close to being completely empty. In this situation, unlike what we saw with *tall*, (6-b) is infelicitous.

(6) a. Pass me **the tall one**.
b. Pass me **the empty one**.

In other words, unlike RAs, AAs cannot change their criteria of application to distinguish between objects that lie in the middle of their associated scale, and therefore the two classes are not context-sensitive in the same way. Of course, saying that absolute adjectives are not at all context-sensitive is clearly false. As discussed by very many authors such as Austin (1962), Unger (1975), Lewis (1979), Pinkal (1995), Kennedy and McNally (2005), Kennedy (2007), and Récanati (2010), although they may not be able to shift their semantic denotation to distinguish between any individuals on their scales, it is easy to see that their criteria of application can change depending on at least some contexts. For example, if we consider a

[2] Note that the non-scalars can be very easily turned into scalar adjectives (i.e. *Mary is more pregnant than Sue: she's farther along*). Gradable uses of NSs will be discussed later in this section.

particular large theatre with two spectators in it, the same theatre might be considered *empty* in the context of evaluating attendance at a play (7-a); however, it might not be considered so in the context of ensuring that no one is left inside during a fumigation or demolition process (7-b).

(7) a. Only two people came to opening night; the theatre was **empty**.
b. Two people didn't evacuate; the theatre wasn't **empty** when they started fumigating.

Likewise, a road that has some twists in it might be considered *straight* in a context in which we are trying to avoid getting car sick, but it may no longer be considered so in a context in which we are surveying the land. And it is very easy to think of similar cases that show the context-sensitivity of adjectives like *flat, dry, clean* etc. These kind of examples are well-known in the literature, and they are all proposed to involve a more restricted kind of context-sensitivity, that which is associated with 'rough' (see Austin, 1962), 'loose' (Unger, 1975; Sperber and Wilson, 1985), 'modulated' (Récanati, 2004, 2010), or 'imprecise' (Pinkal, 1995; Kennedy and McNally, 2005, a.o.) uses of absolute terms.

Turning to non-scalar adjectives, it is easy to see that, like AAs, these predicates are only possible in contexts in which exactly one object is atomic/prime/hexagonal (8).

(8) a. Pass me the atomic one.
(But neither/both are atomic!)
b. Pass me the prime one.
(But neither/both are prime!)
c. Pass me the hexagonal one.
(But neither/both are hexagonal!)

Do these predicates ever have context-sensitive uses? A famous example in the literature of a context-sensitive use of *hexagonal* (originally due to Austin, 1962 and discussed in the context of vagueness and imprecision in Lewis, 1962) is the one in (9).

(9) France is hexagonal.

If we are comparing France to shapes in geometry textbooks, it will not be considered hexagonal (its coastline has very many more 'sides' than six!); however, when we are comparing it to other countries, all of whom also have bumpy coastlines, it may be considered hexagonal. Thus, we have found a case where the criteria for application of the predicate *hexagonal* vary depending on comparison class, and we can conclude that *hexagonal*, in what Austin calls its 'rough' use (and what we have been calling its 'loose' use), is context-sensitive. So, at first glance, it may look as if we do find context-sensitive non-scalar adjectives.

But I believe that this conclusion would be premature. In fact, 'rough' *hexagonal* is perfectly natural in the comparative construction, as shown in (10).

(10) France is more hexagonal than Canada.

So, as soon as we are licensed by the context to apply *hexagonal* to France, we are licensed to compare things in terms of how close they are to being in the extension of the non-scalar use of the predicate. (10) shows that, while the 'rough' use of *hexagonal* is context-sensitive, it is also scalar. In other words, it is being treated as an absolute scalar adjective[3].

We therefore come to our first empirical puzzle, which I call the **context-sensitivity** puzzle (11).

(11) **The Context-Sensitivity Puzzle:**
How can we account for the observation that the context-sensitivity of AAs is more restricted than that of RAs, without proposing that their meaning is context-independent, like that of NSs?

Another empirical dimension along which the classes of relative, absolute and non-scalar adjectives can be distinguished concerns the phenomenon of vagueness. There are many characterizations of what it means to be a vague predicate in the literature; however, in this paper (following Wright, 1975; Smith, 2008; van Rooij, 2010; Cobreros et al., 2012, a.o.), I assume that vague predicates are those that are **tolerant**. We will call a predicate *tolerant* with respect to a scale Θ if there is some degree of change in respect of Θ insufficient ever to affect the justification with which the predicate is applied to a particular case. Immediately, we can see that a relative adjective like *tall* is tolerant. Suppose we are in a context of evaluating the height of North American adult males. In this situation, there is an increment, say 1 mm, such that if someone is tall, then subtracting 1 mm does not suddenly make them not tall. Similarly, adding 1 mm to a person who is not tall will never make them tall. Since height is continuous, we will always be able to find some increment that will make *tall* tolerant. So, if we are considering very small things for whom 1 mm makes a significant difference in size, we can just pick 0.5 mm or whatever. In other words, (12) appears to be true.

(12) For all x, y, if x is tall and x and y's heights differ by at most one millimetre, then y is also tall.

The observation that relative adjectives are tolerant leads straightforwardly to the observation that these predicates gives rise to a paradox for systems like first (or higher) order logic (upon which most formal theories of the semantics of natural language are based) known as the *Sorites*, or the paradox of the 'heap'. Formally, the paradox can be set up in a number of ways. A common one in the literature is (13), where $\sim_P$ is a binary predicate modelling a 'little by little' or 'indistinguishable difference' relation, and propositions such as (12) are stated more generally as (13-d).

[3]Of course, even loose hexagonal fails the definite description test: to be considered loosely hexagonal, an object has to be considered to be at least somewhat close to having six sides.

Note crucially that I am only suggesting that there exists a link between contextual variation and gradability with adjectival predicates, whose syntactic properties allow them to combine directly with degree morphology. The occurrence of degree morphology with imprecise uses of other kinds of constituents is not always possible. For example, while numeral phrases can have imprecise uses (*I arrived at 3 o'clock* (meaning approximately 3 o'clock), these expressions cannot combine with degree morphology: **I arrived at more 3 o'clock than John*; **How 3 o'clock is it?*. I leave the question of the relationship between gradability and imprecision outside the adjectival domain to future research.

(13) **The Sorites Paradox**

a. **Clear Case:** $P(a_1)$
b. **Clear Non-Case:** $\neg P(a_k)$
c. **Sorites Series:** $\forall i \in [1,n](a_i \sim_P a_{i+1})$
d. **Tolerance:** $\forall x \forall y((P(x) \wedge x \sim_P y) \rightarrow P(y))$
e. **Conclusion:** $P(a_k) \wedge \neg P(a_k)$

Thus, in first order logic and other similar systems, as soon as we have a clear case of P, a clear non-case of P, and a Sorites series, through *universal instantiation* and/or repeated applications of *modus ponens*, we can conclude that everything is P and that everything is not P.

We can see that *tall* (for a North American adult male) gives rise to a Sorites argument. We can find someone who measures 6ft to satisfy (13-a), and we can find someone who measures 5ft6" to satisfy (13-b). In the previous paragraph, we concluded that *tall* is tolerant, so it satisfies (13-d), and, finally, we can easily construct a Sorites series based on height to fulfill (13-c). Therefore, we would expect to be able to conclude that this 5ft6" tall person (i.e. someone who is clearly not tall) is both tall and not tall, which is absurd. Relative adjectives as a class show this behaviour. For example, consider the predicate *expensive* in the context of buying a large television (at which exact cent does a TV go from being *expensive* to *not expensive*?), or *long* in the context of a watching a movie (at which exact second does a movie go from being *not long* to *long*?), and so on.

What about absolute adjectives? Are they tolerant and do they give rise to the Sorites?

On the one had, it seems like the answer to these questions is "no." It has been observed (by Pinkal, 1995; Kennedy, 2007, and others) that, in some other contexts, the symptoms of vagueness with AAs disappear. As a first example, we might consider Kennedy's 2007 discussion of the absolute predicate *straight*. He observes that, in some very special cases where our purposes require the object to be perfectly straight, it is possible to say something like (14).

(14) The rod for the antenna needs to be **straight**, but this one has a 1mm bend in the middle, so unfortunately it won't work.
(Kennedy, 2007, p.25)

In this situation, even a 1 mm bend is sufficient to move an object from *straight* to *not straight*, so the boundary between *straight* and *not straight* is sharp and located between the perfectly straight objects and those with any small bend. Therefore, *straight* is not tolerant in this context and does not give rise to a Sorites argument. We can see the same pattern with *empty*. Suppose that we are describing the process of fumigating a theatre. In this case, since having even a single person inside would result in a death, the cutoff point between empty theatres and non-empty theatres would be sharply at 'one or more spectators', and *empty* would be precise.

However, we can also observe that, in most contexts, adjectives like *empty* and *straight* display certain properties that are eerily similar to the properties displayed by *tall* and *expensive*. Consider a context in which we are talking about theatres and whether or not a particular play was well-attended. In this kind of situation, we often apply the predicate *empty* to theatres that are not completely empty (i.e. those with a couple of people in them), and, in this context, *empty* is tolerant: If we are willing to call a theatre with a couple of people in it *empty*, then at what number of spectators does it become *not empty*? Likewise, in most situations, we can refer to objects with slight bends as *straight*, provided the bends are not large enough to interfere with our purposes. And, in these contexts, *straight* is vague with respect to how big these bends are allowed to be before they make an object become not straight. Thus, we have seen both contexts in which AAs display the characteristic properties of vagueness and contexts in which they do not; thus, when we ask whether absolute adjectives are vague, I conclude that the appropriate answer to this question is "not always, but sometimes." In other words, I argue that being vague is a property that is subject to contextual variation. This picture is at odds with the traditional use of the term *vague* (beginning with Peirce, 1901) which takes it to be a context-independent property. Thus, I propose that, in order to account for the empirical patterns described above and in the literature on vagueness, imprecision, and the absolute/relative distinction, we should employ a more nuanced notion, one that makes the contribution of the context fully explicit. I therefore introduce the term *potentially vague*, defined in (15).

(15) **Potential Vagueness:**
An adjective P is *potentially vague* iff there is some context c such that P gives rise to a Sorites argument in c.

Returning for a moment to relative adjectives, we can observe that, for these predicates, there is no difference in the potential vagueness of their positive form and their negation. We saw that *tall* was potentially vague, and we can make the same observation about *not tall:* At what point does adding a millimetre to the height of a 'not tall' person change them into a tall person? In the contexts in which '± one millimetre' counts as an irrelevant change, then *not tall* will also be tolerant; that is, we will generally assent to both the statements in (16).

(16) **Potential vagueness of *tall* and *not tall***:
a. **Tall:** For all x, y, if x is tall and x and y's heights differ by a millimetre, then y is tall.
b. **Not tall:** For all x, y, if x is not tall and x and y's heights differ by a millimetre, then y is not tall.

However, absolute adjectives display a different pattern, and, furthermore, this pattern breaks down along the lines of a well-known distinction between two subclasses of AAs: the *total/partial* distinction (in the terminology of Cruse, 1980, 1986; Yoon, 1996; Rotstein and Winter, 2004) or the *universal/existential* distinction in the terminology of (in the terminology of Kamp and Rossdeutscher, 1994). Examples from these two subclasses are shown in (17).

(17) a. **Total/Universal AAs:**
clean, smooth, dry, straight, flat, healthy, safe, empty, full ...
b. **Partial/Existential AAs:**
dirty, bent, wet, curved, crooked, dangerous, awake...

Consider firstly total AAs like *straight* and *empty*. I argued that these predicates are potentially vague, i.e. we can think of contexts in which we would assent to the principle of tolerance for these predicates. But we can observe that the negations of total AAs behave differently. In particular, even in the same contexts as described above, the principle of tolerance is not valid for *not straight* and *not empty* (18)[4].

(18) **Intolerant *not straight* and *not empty*:**

a. **False:** For all x, y, if x is not straight and x and y's shapes differ by a single 1mm bend, then y is not straight.

b. **False:** For all x, y, if x is not empty and x and y's contents differ by a single item, then y is not empty.

The statements in (18) are falsified by the cases where we move from individuals who are at the endpoint of the relevant scale to those who lie at the second to last degree: although pairs of sticks with bends in them will satisfy instantiations of the principle of tolerance, suppose that I have a stick x with a single 1mm bend. It is conceivable that in the context described above, it would be considered *not straight*; however, if I have a second stick y that has absolutely no bends, then it would never be considered *not straight*, even in this context. Similarly with *empty*: (18-b) is falsified by the case where x has one object and y has zero objects. Thus, total AAs and their negations show a fundamental asymmetry with respect to potential vagueness: while it may be possible to find contexts in which an individual who is not completely straight/empty counts as *straight/empty*, something that is completely straight/empty can never count as *not straight/not empty*. What about partial AAs? We can immediately see a difference between adjectives like *wet, dirty* etc. and *empty, straight* etc.: the negations of partial adjectives are potentially vague. For example, if we are in a situation where a single drop of water does not make a difference to our interests, then *not wet* will be tolerant (19-a). Similarly with *not dirty*: this negated predicate will satisfy the principle of tolerance in cases where one speck of dirt is perceived as irrelevant (19-b).

(19) **Tolerance of *not wet* and *not dirty*:**

a. For all x, y, if x is not wet, and x and y differ by one drop of water, then y is not wet.

b. For all x, y, if x is not dirty, and x and y differ by one speck of dirt, then y is not dirty.

However, with partial AAs, it is the positive form of the adjective that is not potentially vague: even if a single drop/speck is perceived as irrelevant, *wet* and *dirty* do not satisfy tolerance. In particular, objects that are completely dry and completely clean cannot ever be described as *wet* or *dirty* respectively.

(20) **Intolerance of *wet* and *dirty*:**

a. **False:** For all x, y, if x is wet, and x and y differ by one drop of water, then y is wet.

[4] Note that we are analyzing the expression *if...then* as a material implication.

b. **False:** For all x, y, if x is dirty, and x and y differ by one speck of dirt, then y is dirty.

Finally, consider non-scalar adjectives like *atomic* or *hexagonal*: as discussed in Égré and Klinedinst (2011) and van Rooij (2011c) (among others), these constituents are typical examples of precise predicates, and we can verify that both their positive forms and negative forms are intolerant in all contexts[5].

(21) **Intolerance of *prime* and *hexagonal*:**

a. **False:** For all numbers x, y, if x is prime and x and y differ by one, then y is prime.

b. **False:** For all shapes x, y, if x is hexagonal and x and y differ by one side, then y is hexagonal.

(22) **Intolerance of *not prime* and *not hexagonal*:**

a. **False:** For all numbers x, y, if x is not prime and x and y differ by one, then y is not prime.

b. **False:** For all shapes x, y, if x is not hexagonal and x and y differ by one side, then y is not hexagonal.

These patterns therefore give rise to a second empirical puzzle for the analysis of AAs and their relationship to RAs and NSs:

(23) **The Vagueness Puzzle:**
How can we account for the observation that AAs have forms that are potentially vague, like RAs, but also forms that are not potentially vague, like NSs?

- Furthermore, within the set of AAs, how can we account for the differences between total and partial adjectives?

The final features (to be discussed in this paper) through which RAs, AAs, and NSs can be distinguished are their gradability and scale structure. We saw above that AAs can have precise uses (see, for example, (14) or the use of *empty* in the context of fumigating a theatre). As observed by Sapir (1944), Lewis (1979) and Récanati (2010) (among others), the use of *straight* to refer to exactly those objects which have no bends and the use of *empty* to refer to exactly those containers that have no contents is, in fact, not a gradable use of the predicate: in contexts where absolute precision is important, either you have no bends and fall into the extension of *straight*, or you have some bends and fall into its anti-extension. Likewise, either you contain zero objects and are empty, or you contain one or more objects and are therefore not empty. In other words, the scales that are associated with the precise uses of *straight* and *empty* have at most two degrees. Of course, this appears to be at odds with the obvious fact that both total and partial AAs are gradable, i.e. they are clearly associated with highly articulated orders with more than two degrees (24).

[5]Note that we are only talking about non-gradable uses of non-scalar adjectives. We can observe that "loose" uses of non-scalars display the characterizing properties of vague language: how many grooves does an object need to have before it cannot be considered loosely hexagonal?

(24) a. Stick A is **straighter** than stick B, which in turn is **straighter** than stick C.
b. This towel is **wetter** than that one, which is **wetter** than this other one.
c. My glass is **emptier** than your glass, which is **emptier** than Mary's glass.

We therefore have yet another puzzle concerning the semantic properties of AAs and their relationship to NSs and RAs:

(25) **The Gradability Puzzle:**
If AAs have 'all or nothing' semantic denotations, like NSs, how can they be gradable, like RAs?

Although AAs are similar to RAs in that members of both of these lexical classes are associated with non-trivial scales, it is well known that the two classes of adjectives can be further distinguished based the properties of theirs scales, i.e. their **scale structure**. For example, it is generally proposed that total AAs like *dry, straight,* and *clean* are associated with scales that have a maximal element, also known as **top-closed** scales. There are many diagnostics in the literature for the presence of a maximal endpoint[6]; however, for illustrative purposes, I take the tests for being associated with a top-closed scale to be compatibility with adverbial modifiers such as *almost* or *completely.* As observed by Cruse (1986), Rotstein and Winter (2004), and Kennedy and McNally (2005) (among others), while *almost* is perfectly fine with total AAs, it is strange with partial AAs.

(26) a. This towel is **almost** dry/*wet.
b. The stick is **almost** straight/*bent.
c. The table is **almost** clean/*dirty.

Another modifier that appears to target the top endpoint of a scale is *completely* (Kennedy and McNally, 2005). With all kinds of absolute adjectives, this modifier can have a 'mereological' interpretation (i.e. (27-b) can mean something like 'all of the parts of the towel are wet'); however, only total adjectives allow a 'degree' interpretation, for example, where the adverb picks out the maximal degree of dryness in (27-a).

(27) a. This towel is **completely** dry.
(Both mereological and degree interpretation possible.)
b. This towel is **completely** wet.
(Only mereological interpretation possible.)

Furthermore, both *almost* and *completely* are generally much less acceptable with relative adjectives than with total adjectives.

(28) a. John is **almost/completely** *fat/*tall/*wide.
b. This watch is **almost/completely** *expensive/*attractive/*fashionable.

[6]Indeed, the reader is highly encouraged to consult the works of Cruse (1986), Rotstein and Winter (2004), Kennedy and McNally (2005), Kennedy (2007), Sassoon and Toledo (2013) and McNally (2011) (among very many others) for a more complete overview of tests for top/bottom endpoints.

Therefore, based on this grammatical diagnostic, we can conclude that total AAs are associated with articulated scales that have a top endpoint, while both partial AAs and relative adjectives are associated with articulated scales that have no top endpoint. Furthermore, it is generally proposed that partial AAs are associated with scales that have a minimal element, also known as **bottom-closed** scales. There are far fewer tests featuring modifiers in the literature for the presence of a bottom element; however, the diagnostic that I will use in this paper involves the interpretation of the English modifiers *slightly* and *a little*. It seems reasonable to suppose, along the lines of the recent analysis in Solt (2012), that *slightly* or *a little* pick out the set of individuals that lie on an adjective's scale somewhat higher than a particular standard and that the standard can be given by the context or it can be set as a default at the bottom endpoint of the scale. Then we should predict two kinds of interpretations to be possible with adjectives modified by *slightly/a little*. Firstly, when the standard is set by context (which in principle should be possible with all kinds of scalar adjectives), we expect *slightly P* or *a little P* to have an 'excessive' interpretation (i.e. the degree to which the property holds of the subject exceeds our expectations by some small amount). As shown in (29), this prediction is borne out.

(29) a. **RAs:** John is **slightly/a little** tall (for his age).
b. **Total AAs:** His apartment is **slightly/a little** clean (for my taste).
c. **Partial AAs:** This towel is **slightly/a little** wet (for me to use).

On the other hand, if the adjective with which *slightly/a little* combines is associated with a scale that has a bottom endpoint, then we expect a second 'existential' interpretation to be possible (i.e. the degree to which the property holds of the subject exceeds the zero degree by some small amount). As shown in (30), partial AAs allow this existential interpretation: (30) can be said if there is some amount of wetness on the towel or some amount of dirt on your dress, even if this amount does not exceed our expectations. We can therefore conclude that these predicates are associated with scales with bottom endpoints.

(30) a. This towel is **slightly/a little** wet.
$\approx$ There is some wetness on the towel.
b. Your dress is **slightly/a little** dirty.
$\approx$ There is some dirt on your dress.

However, an existential reading of *slightly/a little* is not possible with relative adjectives (31), and nor is such a reading possible with many total AAs such as *clean* and *flat* (32). We can therefore conclude that these adjectives are associated with scales that do not have a bottom endpoint. Thus, relative adjectives are proposed to be associated with *open* scales: orderings that have neither a maximal nor a minimal element[7].

(31) a. John is **slightly/a little** tall.
$\not\approx$ John has some height.

[7]It may seem a little counter-intuitive to classify an adjective like *tall* as being associated with an order that has no minimal element; however, this impressionistic mismatch appears to be warranted based on the linguistic data. See Kennedy and McNally (2005) and McNally (2011) for further arguments that *tall* is an open scale adjective.

b. Mary is **slightly/a little** friendly.
≉ Mary has some positive interactive characteristics.

(32) a. His apartment is **slightly/a little** clean.
≉ There is some cleanliness in his apartment (Only it's a little too clean).
b. This trail is **slightly/a little** flat.
≉ There is some flatness on this trail (Only it's a little too flat).

Although total AAs like *straight* and *dry* are associated with scales that have no bottom endpoint (I will call these predicates *properly total AAs*), it has been observed that some other total AAs also pass the tests for having a scale with a bottom element. As shown in (33) and (34), adjectives such as *closed* and *open* are compatible with both *almost* and the existential interpretation of *slightly*.

(33) a. The door is **almost** closed.
b. The door is **almost** open.

(34) Examples from Solt (2012)
a. He'd lean his head back, his eyes **slightly** closed...
(Ploughshares, Winter97/98, 23/4, p.12)
b. Helene...had been in the bathroom, door cracked, **slightly** open, peeking out through the small gap.
(Analog Science Fiction & Fact, 122/10, p. 108)

Therefore, it is common in the literature (ex. Kennedy and McNally, 2005; Kennedy, 2007; Sassoon and Toledo, 2013) to propose that such adjectives, which I will call *fully closed scale adjectives*, are associated with scales that have both a top and bottom endpoint. Taking the properties of the orders associated with AAs into consideration, we can therefore distinguish between the following three subclasses of absolute scalar adjectives:

(35) **Scale Structure Subclasses of AAs**
a. **Properly Total/Top-closed scale AAs:**
clean, smooth, dry, straight, empty, flat, healthy, safe ...
b. **Partial/Bottom-closed scale AAs:**
dirty, bent, wet, curved, crooked, dangerous, awake...
c. **Fully-closed scale adjectives:**
open, closed, full, opaque, transparent...

The scale structure properties of AAs thus give us a fourth and final puzzle to be tackled in this paper: the **scale structure puzzle**.

(36) **The Scale Structure Puzzle:**
How can we account for the observation that, unlike RAs, which are associated with open scales, AAs are associated with scales that have either a top endpoint, a bottom endpoint or perhaps even two endpoints?

Although in this section I have illustrated the scale structure properties through the distribution and interpretation of modifiers, I highlight that these sample data constitute only the tip of the iceberg when it comes to the importance of scales of different kinds in natural language. In particular, scale structure has been shown to be extremely useful in the analysis of an enormous range of linguistic phenomena, from the distribution of modifiers (discussed above) to the properties of pitch accent and focus (see Unger, 1975; Kennedy and McNally, 2005; Kennedy, 2007), the calculus of verbal aspect (see Hay et al., 1999; Kennedy and McNally, 2005; Kennedy and Levin, 2008, among others), the syntax and semantics of resultative constructions (Beavers, 2008, among others), and the reasoning patterns associated with these predicates (Unger, 1975; Lewis, 1979; Kennedy and McNally, 2005; Burnett, 2013, among many others). Thus, I consider (36) to be an important aspect of the meaning of absolute adjectives that needs to be accounted for in their semantic analysis.

In summary, in this section, I have outlined four puzzles associated with the semantic and pragmatic properties of absolute scalar adjectives and their relation to both relative and non-scalar adjectives. Along each empirical dimension, AAs show a semantic behaviour that appears to be hybrid between RAs and NSs: while still being context-sensitive (like RAs), AAs fail the definite description test (like NSs). While allowing for precise uses and having non-potentially vague forms (like NSs), AAs also have potentially vague forms like (RAs). Finally, while appearing to have an 'all-or-nothing' semantic core (like NSs), AAs are gradable (like RAs), although not in exactly the same way. In the next section, I introduce the Delineation logical framework (DelS) and I examine the previous proposals and general prospects for modelling the puzzling properties of absolute scalar predicates within this approach to the semantics of gradable adjectives.

3 Absolute Adjectives in Delineation Semantics

This section presents an outline of the Delineation Semantics framework. I first lay out a simple DelS system and give an analysis of relative scalar adjectives (along the lines of proposals by Klein and van Benthem). I then explore the possibility of pursuing an analysis of absolute scalar adjectives within this simple framework and show that the four empirical puzzles presented in the previous section cause problems for the analysis of AAs within this logical system and those that share its fundamental properties. I then examine a previous account of AAs within DelS (that of van Rooij, 2011c) and argue that this account leaves some of the puzzles unsolved.

3.1 Basic Delineation Semantics

Delineation semantics is a framework for analyzing the semantics of gradable expressions that takes the observation that they are context sensitive to be their key feature. A delineation approach to the semantics of positive and comparative constructions was first proposed by Klein (1980) (following work by Lewis, 1970; McConnell-Ginet, 1973; Kamp, 1975), and has been further developed by van Benthem (1982), Keenan and Faltz (1985), Larson (1988), Klein (1991), van Rooij (2011b), Doetjes (2010), van Rooij (2011a), and Doetjes et al. (2011), among others. In this framework, scalar adjectives denote sets of individuals and, furthermore, they are evaluated with respect to comparison classes (CCs), i.e. subsets of the domain. The basic idea is that the extension of a gradable predicate can change depending on the set of individuals that it is being compared with. More formally, we start with a basic model (called a **C(lassical) model** in the terminology of Cobreros et al., 2012) in which the interpretation of predicates is relativized to comparison classes as follows:

Definition 3.1. ***C-model.*** *A c-model is a tuple $M = \langle D, [\![\cdot]\!] \rangle$ where D is a non-empty domain of individuals, and $[\![\cdot]\!]$ is a function from pairs consisting of a member of the non-logical vocabulary and a comparison class (a subset of the domain) satisfying:*

- *For each individual constant a_1, $[\![a_1]\!] \in D$.*
- *For each $X \subseteq D$ and for each predicate P, $[\![P]\!]_X \subseteq X$.*

Observe that, unlike in first order logic where predicates are assigned any subset of the domain, in the delineation analysis presented here, predicates are assigned different properties in different comparison classes. For a given utterance of a sentence containing the positive form of a scalar adjective, the relevant comparison class against which the statement is evaluated is given purely by context. Thus, in our analysis, truth in a model is always given with respect to a distinguished comparison class. Note that if the subject of the sentence is not included in the distinguished comparison class, the truth value of the sentence is undefined (as suggested by our judgements concerning sentences like (37)[8]). The undefined value in Definition 3.2 is just one way of dealing with cases where the denotation of the subject is not included in the contextually given comparison class; nothing substantial hinges on this choice.

(37) #Mary is tall for a boy in this class.

Definition 3.2. ***Semantics of the positive form.*** *For all models M[9], all comparison classes $X \subseteq D$, all predicates P and individuals $a_1 \in X$,*

(38)
$$[\![P(a_1)]\!]_{X,M} = \begin{cases} 1 & \text{if } [\![a_1]\!]_M \in [\![P]\!]_{X,M} \\ 0 & \text{if } [\![a_1]\!]_M \in X - [\![P]\!]_{X,M} \\ i & \text{otherwise} \end{cases}$$

We will take the basic semantics of negation to be as shown below:

Definition 3.3. ***Semantics of negation.*** *For all models M, $X \subseteq D$ and formulas ϕ,*

[8]Note that this is an idealization: there are counterexamples to this pattern, such as (i) whose treatment goes beyond the scope of this paper.

(i) Mia wants an expensive hat *for a three year old.*

I thank an anonymous reviewer for bringing these examples to my attention. See Schwartz (2010), Solt (2011) and Schwarzschild (2013) for more discussion of these cases.

[9]In the bulk of the paper, for readability considerations, I will often omit the model notation, writing only $[\![\cdot]\!]_X$ for $[\![\cdot]\!]_{X,M}$.

$$(39) \qquad [\![\neg\phi]\!]_{X,M} = \begin{cases} 1 & \textit{if } [\![\phi]\!]_{X,M} = 0 \\ 0 & \textit{if } [\![\phi]\!]_{X,M} = 1 \\ i & \textit{otherwise} \end{cases}$$

The definitions given above constitute a very simple analysis of the semantics of positive and negative gradable adjectives. In fact, it is too simple. As discussed in Klein (1980) and van Benthem (1982), if we put no restrictions on how the denotations of scalar predicates can be applied across comparison classes, then we will allow some counter-intuitive results. For example, nothing at the moment prohibits the application of a predicate like *tall* such that, in one comparison class containing John and Mary, it classifies John as tall and Mary as not tall, while in another comparison class within the same model, it classifies Mary as tall and John as not tall. But clearly scalar predicates in natural language do not work like this. So we have a problem.

The standard solution to this problem involves imposing some constraints on how predicates like *tall* can be applied in different CCs. The proposal that the interpretation of scalar predicates is constrained by certain intuitive axioms is an integral part of the delineation framework. Unlike other approaches (like degree semantics, cf. Kennedy, 1997 for an overview of this framework) that put constraints on degree structures in the ontology, in the Klein-ian framework, these constraints are put directly on how scalar predicates can be interpreted at different comparison classes. In other words, we can observe that the application of relative scalar predicates like *tall* in natural language is guided by certain monotonicity principles, and so we build these principles into the interpretation function. There exist a few proposed constraint-sets in the literature (ex. Klein, 1980; van Benthem, 1982; van Rooij, 2011a,c). Probably the best-known is that of van Benthem (1982) and van Benthem (1990)[10]. Van Benthem proposes three axioms governing the categorization of individuals across comparison classes. They are the following (presented in my notation):

> For all models M, all $a_1, a_2 \in D$ and $X \subseteq D$ such that $a_1 \in [\![\mathrm{P}]\!]_{X,M}$ and $a_2 \notin [\![\mathrm{P}]\!]_{X,M}$,

Axiom 3.1. ***No Reversal (NR):*** *There is no $X' \subseteq D$ such that $a_2 \in [\![P]\!]_{X',M}$ and $a_1 \notin [\![P]\!]_{X',M}$.*
Axiom 3.2. ***Upward difference (UD)****: For all X', if $X \subseteq X'$, then there is some a_3, a_4 : $a_3 \in [\![P]\!]_{X',M}$ and $a_4 \notin [\![P]\!]_{X',M}$.*
Axiom 3.3. ***Downward difference (DD)****: For all X', if $X' \subseteq X$ and $a_1, a_2 \in X'$, then there is some a_3, a_4 : $a_3 \in [\![P]\!]_{X',M}$ and $a_4 \notin [\![P]\!]_{X',M}$.*

No Reversal states that if there is some CC in which a_1 is classified as P and a_2 is classified as *not P*, there is no other CC in which they switch. **Upward Difference** states that if, in one comparison class, there is a P/*not* P contrast, then a P/*not* P contrast is preserved in every larger CC. In other words, if there is some reason that, in some comparison class, we made

[10]As pointed out by Kennedy (2011) and van Rooij (2011a), adopting van Benthem's axioms has certain, perhaps unintuitive, consequences for how closely the use of the positive form (i.e. *tall*) and the comparative form (i.e. *taller*) must coincide. To account for these contrasts, van Rooij enriches van Benthem's proposal with other constraints. For the purposes of this paper, I end up adopting van Benthem's axioms, since they are both better known and simpler; however, van Rooij's 2011a axiom set could just as well be implemented in the framework developed here.

a distinction between some individuals with respect to P, adding extra individuals to CCs cannot erase all distinctions (although they might shift). Finally, **Downward Difference** says that if, in some comparison class, there is a *P/not P* contrast involving a_1 and a_2, then there remains a contrast in every smaller CC that contains both a_1 and a_2.

Although the comparison-class-based variation restricted by van Benthem's axioms gives us a nice analysis of the extreme context-sensitivity of predicates such as relative adjectives, in fact, it gives us much more. A major feature of the delineation approach is that the scalarity/gradability of an adjective is **derived** from its context-sensitivity. The scales associated with particular adjectival predicates (as well as the denotation of the comparative) are defined as follows:

Definition 3.4. ***Semantics for the comparative***. *For all models M, all $X \subseteq D$, all individuals a_1, a_2, and predicates P,*

(40) $$[\![a_1 >_P a_2]\!]_{X,M} = \begin{cases} 1 & \textit{if there is some } X' \subseteq D : [\![P(a_1)]\!]_{X',M} = 1 \textit{ and } [\![P(a_2)]\!]_{X',M} = 0 \\ 0 & \textit{otherwise} \end{cases}$$

Informally, in this framework, *John is taller than Mary* is true (i.e. $John >_{tall} Mary$) just in case there is some comparison class with respect to which John counts as tall and Mary counts as not tall. More generally, van Benthem shows that these axioms give rise to *strict weak orders*: irreflexive, transitive and almost connected relations.

Definition 3.5. ***Strict weak order***. *A relation $>$ is a strict weak order just in case $>$ is* ***irreflexive****,* ***transitive****, and* ***almost connected***[11]*.*

As discussed in Klein (1980), van Benthem (1990) and van Rooij (2011b), strict weak orders (also known as *ordinal scales* in measurement theory) intuitively correspond to the types of relations expressed by many kinds of comparative constructions[12]. For example, one cannot be taller than oneself; therefore $>_{tall}$ should be irreflexive. Also, if John is taller than Mary, and Mary is taller than Peter, then we know that John is also taller than Peter. So $>_{tall}$ should be transitive. Finally, suppose John is taller than Mary. Now consider Peter. Either Peter is taller than Mary or he is shorter than John. Therefore, $>_{tall}$ should be almost connected.

In summary, in DelS, the extension of gradable predicates varies across comparison classes (subject to certain weak constraints), and the non-trivial orderings that are associated with such predicates are constructed from this comparison-class-based variation. Therefore, as I highlight here, there exists a very tight analytical connection between context-sensitivity and gradability in this framework (i.e. gradability is **derived** from context-sensitivity).

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[11]

Definition 3.6. ***Irreflexivity***. *A relation $>$ is irreflexive iff there is no $x \in D$ such that $x > x$.*
Definition 3.7. ***Transitivity.*** *A relation $>$ is transitive iff for all $x, y, z \in D$, if $x > y$ and $y > z$, then $x > z$.*
Definition 3.8. ***Almost Connectedness***. *A relation $>$ is almost connected iff for all $x, y \in D$, if $x > y$, then for all $z \in D$, either $x > z$ or $z > y$.*

[12] Although see recent experimental work by Solt and Gotzner (2012) that suggests that stronger orderings are needed to model some kinds of natural language comparatives.

3.2 Absolute Adjectives in Basic Delineation Semantics

The classic works in DelS (Kamp, Klein, van Benthem etc.) deal exclusively with the analysis of relative adjectives; however, we saw in section 2 that AAs have many different properties than RAs. For example, their ability to change their extension depending on comparison class is much more reduced, as shown by their infelicity in the definite description test. How should we account for this difference in context-sensitivity within the delineation framework?

One possibility, which is considered in van Rooij (2011c), is to suppose that, unlike RAs, AAs have a non-context-sensitive semantic denotation. In a semantic framework based on comparison classes, what it means to be non-context-sensitive is to have your denotation be invariant across classes. We might therefore propose that an additional axiom governs the semantic interpretation of the members of the absolute class that does not apply to the members of the relative class: (what I will call) the *absolute adjective axiom (AAA).* The AAA essentially states that, for an absolute adjective Q and a comparison class X, it suffices to look at what the extension of Q is in the maximal CC, the domain D, in order to know what $[\![Q]\!]_X$ is. In other words, the semantic denotation of an absolute adjective is set with respect to the total domain, and then, by the AAA, the interpretation of Q in D is replicated in each smaller comparison class.

Axiom 3.4. ***Absolute Adjective Axiom (AAA).*** *For all absolute and non-scalar predicates Q_1, all interpretations $[\![\cdot]\!]_M$, all $X \subseteq D$ and $a_1 \in X$,*

1. *If $[\![Q_1(a_1)]\!]_{X,M} = 1$, then $[\![Q_1(a_1)]\!]_{D,M} = 1$.*
2. *If $[\![Q_1(a_1)]\!]_{D,M} = 1$, and $[\![Q_1(a_1)]\!]_{X,M} \neq i$[13], then $[\![Q_1(a_1)]\!]_{X,M} = 1$.*

Although the AAA has the effect of greatly reducing the possible contextual variation for an absolute predicate, van Rooij quickly rejects this proposal for the following reason: the proposal presented in this section makes a very strong (and incorrect) prediction, namely that the scales that are associated with the semantic denotations of absolute constituents should be very small, essentially trivial. In particular, if a predicate obeys the AAA, then the relations denoted by its comparative ($>_Q$) do not allow for the predicate to distinguish three distinct individuals. This result is stated as Theorem 3.1.

Theorem 3.1. *If a predicate Q's interpretation obeys the AAA, then there is no model M such that, for distinct $a_1, a_2, a_3 \in D$, $a_1 >_Q a_2 >_Q a_3$*[14].

Although a simple analysis in which a predicate obeys the AAA may be appropriate for non-scalar adjectives[15], it is clearly inappropriate for absolute scalar adjectives. As discussed in

[13]The addition of this clause involving an indefinite truth value in the antecedent of 2. is simply to make sure we cover the case where a_1 is not even in the smaller comparison class X. The indefiniteness here has no substantial consequences on the analysis.

[14]PROOF: Let Q satisfy the AAA. Suppose for a contradiction that there is some model $M = \langle D, [\![\cdot]\!]\rangle$ such that a_1, a_2, a_3 are distinct members of D, and $a_1 >_Q a_2 >_Q a_3$. Then, by definition 3.4, there is some $X \subseteq D$ such that $a_1 \in [\![Q]\!]_X$ and $a_2 \notin [\![Q]\!]_X$. Therefore, by the AAA, $a_2 \notin [\![Q]\!]_D$. Furthermore, since $a_2 >_Q a_3$, there is some $X' \in CC$ such that $a_2 \in [\![Q]\!]_{X'}$ and $a_3 \notin [\![Q]\!]_{X'}$. Since $a_2 \in [\![Q]\!]_{X'}$, by the AAA, $a_2 \in [\![Q]\!]_D$. $\perp$ So there is no model M such that, for distinct $a_1, a_2, a_3 \in D$, $a_1 >_Q a_2 >_Q a_3$. □

[15]For example, if someone tells me (i), my reaction to this, after I have recovered from the strangeness of the statement, is to say, "Why yes; yes it certainly is."

section 2, it is perfectly acceptable and very natural to use absolute comparatives like those in (41).

(41) a. Room A is emptier than room B, which is emptier than room C.
b. This towel is wetter than that one, but neither are as wet as towel C.
c. Ottawa is cleaner than Montréal, which are both cleaner than Paris.

In other words, in our quest to solve the context-sensitivity puzzle (11), we have fallen right into the gradability puzzle (25). This is no accident. Since, as discussed in the previous section, scalarity is derived from context-sensitivity in DelS, restricting one necessarily restricts the other. It is in this way (as observed by Kennedy, 2007; McNally, 2011; van Rooij, 2011c)[16] that the properties of absolute scalar adjectives pose a special challenge for delineation semantics: by virtue of the basic architecture of the framework, the context-sensitivity and gradability puzzles are intertwined in the following way:

(42) **Context-Sensitivity/Gradability Paradox for Delineation Semantics:**
a. If gradability is derived from context-sensitivity, **and**
b. AAs are not context-sensitive, **then**
c. **How can they be gradable?**

Things get even more dire for the delineation framework when we consider the scale structure puzzle (36). In the delineation approach to gradable predicates, as in some degree semantics approaches (ex. Cresswell, 1977), Bale (2011), 'degrees' on a scale for a predicate P consist of the set of individuals that are equivalent with respect to $>_P$ (cf. the discussion in van Rooij (2011b)). Since degrees are equivalence classes of individuals, if the domain D is finite, as is often assumed in linguistics, then the scales associated with all adjectival predicates will have endpoints, and the number of distinct degrees will be necessarily limited by the cardinality of D. Thus, by definition, all scales over finite domains (be they associated with RAs, partial AAs, or total AAs) must have both a top element and a bottom element. So how can we account for the open, top-closed and bottom-closed distinction in the framework developed here? Thus, the empirical puzzle in (36) gives rise to the theoretical paradox in (43).

(43) **Scale Structure Paradox for Delineation Semantics:**
a. If the domain is finite, **and**
b. Degrees on a scale are equivalence classes of individuals, **then**
c. **How can a scale be (partially) open?**

(i) 5 is **more prime** than 6.

[16] This challenge for DelS is stated by Kennedy (2007) as follows (p.41): "In particular, an analysis that derives gradability from a general, nonscalar semantics for vague predicates must explain the empirical phenomena that have been the focus of this paper: the semantic properties of relative and absolute gradable adjectives in the positive form. While it may be difficult but not impossible to explain some of these features, I do not see how such an approach can account for the basic facts of the relative/absolute distinction in a non-stipulative way. . . the challenge for a non-degree-based analysis is to explain why only relative adjectives are vague in the positive form, while absolute adjectives have fixed positive and negative extensions, but remain fully gradable.

With these two challenges for DelS in mind, I turn to a previous analysis of absolute scalar adjectives within this framework: van Rooij (2011c).

3.3 van Rooij (2011c): Changing Standards of Precision

A recent analysis of AAs within DelS that avoids running into the context-sensitivity/gradability paradox is the one proposed in van Rooij (2011c). Van Rooij suggests that, contrary to the line of analysis that was pursued above, the semantic denotations of AAs **do** in fact vary across comparison classes; in other words, he proposes that AAs do not satisfy the AAA, but rather satisfy certain weaker constraints more similar to those obeyed by RAs. Thus, there is no mystery about where the articulated scales associated with AAs come from: they are derived in a parallel manner to those associated with RAs. The puzzle now becomes how to analyze the restricted context-sensitivity that we see with these predicates.

In order to account for why AAs fail the definite description test, van Rooij proposes to weaken the link between the use of the positive form of the predicate and its use in the comparative. He suggests that the use of the positive forms of an AA, unlike the use of a positive RA, always selects the maximal comparison class for evaluation. He says (p.22),

> In terms of our framework, what this suggests is that the use of the positive absolute adjective (in contrast to the use of the adjective in a comparative) demands that the comparison class with respect to which the adjective is interpreted is simply the whole domain, and thus that only those individuals can be called *flat*, that are the flattest of all the individuals in the whole (context independent) domain.

This analysis captures half of both the context-sensitivity and vagueness puzzles: since the interpretation of the positive form of an AA is tied to the maximal (context-independent) comparison class, it cannot be used to distinguish between two elements at the middle of an AA's associated scale. Furthermore, this context-independence explains why AAs, perhaps unlike RAs, have salient precise uses. However, the puzzles are not yet solved because, as van Rooij notes (p.41),

> An unfortunate consequence of this analysis, or so it seems, is that we have to conclude that absolute adjectives can hardly ever be used. This, however, seems to contradict actual practice. Moreover, the analysis cannot explain why absolute adjectives like *flat* and *full* allow for valuable interpretation and give rise to the Sorites paradox: just how bumpless should a table be to be called *flat*?, and how much liquid should a bottle contain before it can be called *full*? Thus, the puzzle then is to explain our daily use of absolute terms, and why they give rise to vagueness.

Following influential work by Lewis (1979) and Hobbes (1985), van Rooij proposes that the context-sensitivity and vagueness that we see with AAs is not due to comparison-class-based indexicality, as with RAs; rather, it is due to changing contextual standards of precision, formally modelled as variation in the **granularity** of cognitive models. Formally speaking then, our model structures now contain not a single model, but a **set** of models $\mathcal{M}$ that share a domain; that is, for all $M, M' \in \mathcal{M}$, $D_M = D_{M'}$. Furthermore, since the domains of the models M and M' are the same, the sets of comparison classes of M and M' are also the same. The models in $\mathcal{M}$ differ, however, in how the absolute predicates are assigned across comparison classes, and the idea is that, for an absolute predicate Q, some models in $\mathcal{M}$ might make more distinctions based on Q than others, resulting in the comparative relations in one model being different from the comparative relations in another[17]. We can therefore define a **refinement** relation between models, and contextual variation in the application of an absolute predicate can therefore be analyzed as variation across models based on the relation in (44). For example, a floor that has a couple of small bumps on it may fall into the (comparison class independent) extension of *flat* in a model M, but there may be a refinement of M, M', in which the standards of precision are higher, in which the same object would no longer be considered as *flat*.

(44) M' is a **refinement** of M w.r.t a predicate P iff $[\![>_P]\!]_M \subseteq [\![>_P]\!]_{M'}$.

This analysis captures many of the puzzling properties of AAs that we have seen so far: it correctly predicts that AAs should show restricted context-sensitivity compared to RAs, yet still have some degree of context-sensitivity. It accounts for the observation that AAs can have precise comparison-class independent 'all-or-nothing' uses like NSs, yet still allow for vague 'loose' uses like RAs[18]. Furthermore, since it is proposed that the use of an AA in a comparative construction still involves comparison-class-based variation, the analysis does not fall into the context-sensitivity/gradability paradox for DelS discussed in (42).

Despite these positive features, I suggest that the 'changing standards of precision' account, at least in its current form, does not adequately capture all the data discussed in this article. Firstly, although AAs are predicted to have vague uses, as far as I can see, there is no immediately obvious account within this theory for the asymmetries in the potential vagueness that were discussed in section 2 (i.e. we could find contexts in which *dry* could give rise to a Sorites paradox, but we could find no such contexts for *wet*, which the reverse holds for *not dry* and *wet*). So the vagueness puzzle (23) is only half-solved. Secondly, although AAs are predicted to be gradable in van Rooij's analysis, the scales associated with AAs are constructed in the same manner as those associated with RAs, so it is not clear how to explain the differences in scale structure between the RA and AA classes. Of course, the scale structure puzzle (36) goes beyond this particular analysis; as discussed in the previous section, the question how to express general notions of scale structure within Delineation semantics is very much open (cf. (43)).

Finally, we might observe that, although the 'changing standards of precision' analysis avoids the gradability paradox, the way in which it does so is by essentially severing the link between the actual use of the positive form (which is comparison-class independent) and the construction of the comparative relation (which proceeds through comparison-class variation). Although there is nothing technically wrong with this aspect of the proposal, it seems to me that it undercuts one of the more interesting and distinctive hypotheses of DelS, namely that

[17]For example, suppose there is a model $M \in \mathcal{M}$ such that $D_M = \{x, y, z\}$. Suppose $[\![Q]\!]_D = \{x\}$; $[\![Q]\!]_{\{x,y\}} = \{x\}$; and $[\![Q]\!]_{\{y,z\}} = \{y\}$. Therefore, in this model, $x >_Q y >_Q z$. Now consider $M' \in \mathcal{M}$ such that $D_{M'} = \{x, y, z\}$, and suppose that $[\![Q]\!]_D = \{x, y\}$; $[\![Q]\!]_{\{x,y\}} = \{x, y\}$ and $[\![Q]\!]_{\{y,z\}} = \{y\}$. In this model, $x, y >_Q z$, but Q makes no distinctions between x and y. Thus, $[\![>_Q]\!]_{M'} \subseteq [\![>_Q]\!]_M$. We therefore say that M is a *refinement* of M', (cf. (44)).

[18]van Rooij pursues a *contextualist* account of the puzzling properties of vague language; therefore, context-sensitivity and vagueness go hand in hand in this kind of approach.

the use of the comparative form should be a function of the use of the positive form. If the denotations of the positive forms of absolute adjectives are always determined by their value at the maximal comparison class, why should they vary in smaller comparison classes?

In order to preserve the connection between the use of the positive form and its use in the comparative, I propose to re-adopt the AAA (repeated in (45)). This boils down to proposing that, at the level of their semantic denotations, absolute scalar predicates have the same kind of context-independent denotations as non-scalar predicates[19].

(45) **Absolute Adjective Axiom (AAA).**
For all absolute and non-scalar predicates Q_1, all interpretations $[\![\cdot]\!]_M$, all $X \subseteq D$ and $a_1 \in X$,
1.If $[\![Q_1(a_1)]\!]_{X,M} = 1$, then $[\![Q_1(a_1)]\!]_{D,M} = 1$.
2.If $[\![Q_1(a_1)]\!]_{D,M} = 1$, and $[\![Q_1(a_1)]\!]_{X,M} \neq i$, then $[\![Q_1(a_1)]\!]_{X,M} = 1$.

In the previous section, we saw that adopting the AAA within a basic delineation system makes the (incorrect) prediction that AAs should not be gradable. However, in the next section, I will present a new analysis that, while it keeps the AAA, does not make such a prediction.

4 Delineation Tolerant, Classical, Strict

The discussion of DelS and the challenges raised by AAs centred primarily around the context-sensitivity and gradability data, while largely ignoring the vagueness data. This is because a variety of styles of analyses of vague language are compatible with the delineation approach to the analysis of adjectival scalarity. For example, Lewis (1970), Kamp (1975) and Klein (1980) pursue a *supervaluationist* analysis of the vagueness of scalar adjectives, while van Rooij (2011a), on the other hand, pursues a *contextualist* account. The solution to the puzzles associated with AAs that I will present will pursue a third style of analysis of the vagueness patterns described in section 2: a multi-valued analysis.

4.1 Tolerant, Classical, Strict Extension

I extend the delineation system proposed above to analyze the semantics of scalar and non-scalar adjectives with a version of Cobreros et al.'s 2012 *Tolerant, Classical, Strict* non-classical logic for modelling the puzzling properties of vague language. This system was originally developed as a way to preserve the intuition that vague predicates are *tolerant* (i.e. satisfy $\forall x \forall y[P(x) \,\&\, x \sim_P y \rightarrow P(y)]$, where $\sim_P$ is an indifference relation for a predicate P),

[19]Note that it may be possible that the AAA, as stated, is a bit strong, at least for some adjectives. For example, as discussed in McNally (2011), whether or not we call a glass *full* (or even *completely full*) can depend on context since we might consider a wine glass or an espresso cup to be full even if its capacity is only half filled with liquid. One suggestion would be to weaken the AAA a bit with these adjectives, while still proposing that AAs obey stronger constraints than van Benthem's, which RAs are subject to in my analysis. This being said, I leave the task of finding these constraints and the more general question of the existence of limited contextual variation in the semantic denotation of AAs to future research.

without running into the Sorites paradox. Cobreros et al. (2012) adopt a non-classical logical framework with three notions of satisfaction: classical (i.e. regular semantic) truth, tolerant truth, and its dual, strict truth. Formulas are tolerantly/strictly satisfied based on classical truth and predicate-relative, possibly non-transitive *indifference relations*. For a given predicate P, an indifference relation, $\sim_P$, relates those individuals that are viewed as sufficiently similar with respect to P. For example, for the predicate *tall*, $\sim_{tall}$ would be something like the relation "looking like having roughly the same height". In this framework, we say that *John is tall* is tolerantly true just in case John has a very similar height to someone who is classically tall (i.e. has a height greater than or equal to some contextually given 'tallness' threshold)[20].

Firstly, we extend our c-models to *tolerant* models by adding the function $\sim$ in the way shown in definition 4.1.

Definition 4.1. ***T(olerant)-model.*** *A t-model is a tuple $M = \langle D, [\![\cdot]\!], \sim\rangle$, where $\langle D, [\![\cdot]\!]\rangle$ is a c-model and $\sim$ is a function from predicate/comparison class pairs such that:*

- *For all P and all $X \subseteq D$, $\sim_P^X$ is a binary relation on X.*

In what follows, we will put some constraints on the definition of $\sim$ to ensure that the $\sim_P$s behave like coherent indifference/similarity relations across comparison classes. I will present each proposed constraint in detail below; however, we first define tolerant and strict denotations (relativized to comparison classes) as in definition 4.2.

Definition 4.2. ***Tolerant/Strict CC denotations.*** *For all predicates P and $X \subseteq D$,*

1. $[\![P]\!]^t_X = \{x : \exists d \sim_P^X x : d \in [\![P]\!]_X\}$.
2. $[\![P]\!]^s_X = \{x : \forall d \sim_P^X x, d \in [\![P]\!]_X\}$.

We can observe that, by virtue of the existential quantifier in definition 4.2 (1.), the tolerant denotation of a predicate will include its classical/semantic denotation, but may also include additional individuals in its anti-extension. Thus, the tolerant denotation of a predicate like *empty* might be the property of being 'loosely empty' or 'approximately empty'[21]. On the other hand, the universal quantifier in definition 4.2 (2.) ensures that the individuals in a predicate's strict denotation are all contained in its semantic denotation. This denotation is also constructed pragmatically and corresponds to the property of clearly or definitely instantiating a gradable property in the context. For example, the strict denotation of a predicate like *wet* might be the property of being 'really wet' (in the context), and the strict denotation of a predicate like *bent* might be the property of being very bent (again, in the context).

More generally, it is easy to see that the fact in (46) holds (based on a similar observation by

[20] Unfortunately, because of space constraints, I will not be able to go over the original formulations and properties of this framework, nor will I be able to recount how it explains the puzzling features of vague language. Instead, I will simply integrate the non-classical aspects of TCS into the comparison-class-based framework as follows; however, the reader is recommended to consult the original paper (Cobreros et al., 2012) or Burnett (2012) for a detailed overview of this logical system.

[21] In other words, a constituent's tolerant denotation is very similar to what Lasersohn (1999) calls its *pragmatic halo* in his closely related framework. For a detailed comparison between the TCS framework and Lasersohn's Pragmatic Halos framework, see Burnett (2012).

Cobreros et al.'s 2012 *Lemma 1*):

(46) **Relationship between semantic and pragmatic denotations:**
For all predicates P and all $X \subseteq D$, $[\![P]\!]^s_X \subseteq [\![P]\!]_X \subseteq [\![P]\!]^t_X$.

Finally, the tolerant/strict semantics for the positive form of an adjective with respect to a comparison class is given as in definition 4.3.

Definition 4.3. ***Positive form.*** *For all t-models M, all $X \subseteq D$, all predicates P, and all $a_1 \in D$,*

1. $$[\![P(a_1)]\!]^t_{X,M} = \begin{cases} 1 & \textit{if } [\![a_1]\!]_M \in [\![P]\!]^t_{X,M} \\ 0 & \textit{if } [\![a_1]\!]_M \in X - [\![P]\!]^t_{X,M} \\ i & \textit{otherwise} \end{cases}$$

2. $$[\![P(a_1)]\!]^s_{X,M} = \begin{cases} 1 & \textit{if } [\![a_1]\!]_M \in [\![P]\!]^s_{X,M} \\ 0 & \textit{if } [\![a_1]\!]_M \in X - [\![P]\!]^s_{X,M} \\ i & \textit{otherwise} \end{cases}$$

One of the characteristic properties of TCS is its definition of negation. The tolerant and strict interpretations of negative sentences are given in definition 4.4.

Definition 4.4. ***Tolerant/Strict semantics for negation.***

1. *For all models M, $X \subseteq D$ and formulas ϕ,*

(47) $$[\![\neg\phi]\!]^t_{X,M} = \begin{cases} 1 & \textit{if } [\![\phi]\!]^s_{X,M} = 0 \\ 0 & \textit{if } [\![\phi]\!]^s_{X,M} = 1 \\ i & \textit{otherwise} \end{cases}$$

2. *For all models M, $X \subseteq D$ and formulas ϕ,*

(48) $$[\![\neg\phi]\!]^s_{X,M} = \begin{cases} 1 & \textit{if } [\![\phi]\!]^t_{X,M} = 0 \\ 0 & \textit{if } [\![\phi]\!]^t_{X,M} = 1 \\ i & \textit{otherwise} \end{cases}$$

An important consequence of the definitions above is that, at the level of tolerant satisfaction, TCS (and by extension the Delineation TCS system presented here) is *paraconsistent*: it allows statements like (49) to be true without explosion.

(49) a. Mary is both tall and not tall.
b. This theatre is both empty and not empty.
(It has some people in it, but loosely speaking it's empty.)
c. This towel is both wet and not wet.
(There is some water on it, but I can still use it to dry myself off.)

Many recent experimental studies on contradictions with borderline cases of vague predicates have found that such sentences are not only tolerated but, in fact, favoured by natural language speakers. For example, Alxatib and Pelletier (2010) find that many participants are inclined to permit what seem like overt contradictions of the form in (49-a) with borderline cases. Additionally, Ripley (2011) finds similar judgements for the predicate *near*.

Finally, we define the tolerant and strict interpretation of the comparative as follows:

Definition 4.5. ***Comparative form.*** *For all models M, $X \subseteq D$, predicates P, and $a_1, a_2 \in D$,*

1. $[\![a_1 >_P a_2]\!]^t_X = 1$ *iff there is some* $X' \subseteq D$ *such that* $[\![P(a_1)]\!]^t_{X',M} = 1$ *and* $[\![P(a_2)]\!]^t_{X',M} = 0$.
2. $[\![a_1 >_P a_2]\!]^s_X = 1$ *iff there is some* $X' \subseteq D$ *such that* $[\![P(a_1)]\!]^s_{X',M} = 1$ *and* $[\![P(a_2)]\!]^s_{X',M} = 0$.

4.1.1 The Properties of Indifference

As it stands, we have not placed any constraints on the definition of $\sim$. However, like the case discussed earlier in this paper with the interpretation of relative predicates, if we do not say anything about how indifference relations can be established across comparison classes, the $\sim_P$s will not look at all like the cognitive indifference relations that they are supposed to be modelling. In what follows, I will propose a series of constraints that the $\sim$ function must satisfy across comparison classes.

The first property that is generally proposed to characterize indifference/similarity relations is reflexivity (see Luce, 1956; Pogonowski, 1981; Cobreros et al., 2012, among many others). Intuitively, every individual is indifferent from itself. Thus, we adopt the constraint in (50) that enforces reflexivity across CCs.

(50) **Reflexivity (R):** For all predicates P, all models M, all $X \subseteq D$,
for all $a_1 \in X$, $a_1 \sim^X_{P_1} a_1$ in M.

In addition to being reflexive, indifference and similarity relations are generally proposed to be symmetric (ex. the original formulation of TCS in Cobreros et al., 2012). At first glance, this seems reasonable: if an individual a is considered indifferent from an individual b, then surely b must also be considered indifferent from a. However, there is a fair amount of literature in both philosophy and psychology that argues that, in certain cases, judgements of similarity are directional (ex. Tversky (1977), Tversky and Gati (1978), Rosch (1978), Ortony et al. (1985), Lakoff (1987), and Égré and Bonnay (2010)). The cases for which it has been proposed that symmetry fails in judgements of similarity and indifference particularly involve relations between individuals that differ in terms of 'prototypicality' (see Tversky, 1977; Rosch, 1978; Ortony et al., 1985; Lakoff, 1987). The generalization concerning asymmetric judgements of similarity can be stated (in the words of Ortony et al., 1985 (p. 570)) as follows[22]:

[22](51) is a robust generalization that has been observed in studies of judgements of similarity with respect to colours, geographical concepts, letters, sounds, and shapes (cf. Tversky (1977) and Lakoff (1987) for literature

(51) **Prototypicality Generalization:**
Atypical members of categories tend to be judged as more similar to typical members than the other way around.

In section 2, I argued that we saw a similar asymmetry in judgements of indifference with absolute adjectives. In particular, we saw that, with total AAs like *empty*, members of the adjective's semantic denotation (i.e. those individuals that always count as *empty*) are never indifferent from members outside the semantic denotation. However, we also saw that, depending on context, individuals that are not completely empty can be considered indifferent from the completely empty ones. Therefore, I believe that it is a reasonable hypothesis that the patterns with AAs discussed in section 2 are instances of a more general phenomenon in which prototypical members of a predicate's denotation have a different status than less prototypical members[23]. Formally, I propose that these asymmetries are encoded into the indifference relations associated with total and partial AAs by means of the following two pragmatic axioms[24]. Since the $\sim_P$ relation is now not necessarily symmetric, $a \sim b$ can now be read as $\langle a, b\rangle \in \sim^X_Q$, 'b can count as a', 'b approximates a' or 'b resembles a'. I highlight here that the $\sim_P$ relations are not meant to be picking out metaphysical relations like '± one drop of water' (which, of course, are symmetric), but rather epistemic relations that express indifference with respect to categorization using P.

(52) **Possible (non)Symmetry in $\sim$:**
1. **Symmetry (S):** For a relative predicate P_1, a model M, and $a_1, a_2 \in D$, if $a_1 \sim^X_{P_1} a_2$ in M, then $a_2 \sim^X_{P_1} a_1$ in M.
2. **Total Axiom (TA):** For a total predicate Q_1, a model M, and $a_1, a_2 \in D$, if $[\![Q_1(a_1)]\!]_{M,D} = 1$ and $[\![Q_1(a_2)]\!]_{M,D} = 0$, then $a_2 \not\sim^X_{Q_1} a_1$ in M, for all $X \subseteq D$.
3. **Partial Axiom (PA):** For a partial predicate R_1, a model M and $a_1, a_2 \in D$, if $[\![R_1(a_1)]\!]_{M,D} = 1$ and $[\![R_1(a_2)]\!]_{M,D} = 0$, then $a_1 \not\sim^X_{R_1} a_2$ in M, for all $X \subseteq D$.

In other words, suppose a is a towel that is completely dry ($[\![\text{dry(a)}]\!]_X = 1$) and b is a towel

reviews). For example, Tversky (1977) shows that, when asked to judge similarity between pairs of countries, participants overwhelmingly judge the less prominent country to be more similar to the more prominent country than vice versa. More specifically, out of 69 participants, 66 preferred the sentence (i-a) over (i-b), and similar results were obtain for pairs of sentences like (ii) and (iii).

(i) a. North Korea is similar to Red China.
b. Red China is similar to North Korea.

(ii) a. Mexico is similar to the USA.
b. The USA is similar to Mexico.

(iii) a. Luxembourg is similar to Belgium.
b. Belgium is similar to Luxembourg.

[23] The view of the difference between RAs and AAs that I am suggesting here is similar in spirit (although very different in its execution) as a proposal by McNally (2011) based on Hahn and Chater (1998) in which the semantic denotations of RAs are determined based on context-sensitive similarity relations and the denotations of AAs are determined based on lexical rules.

[24] A similar strategy was adopted in the analysis of the total/partial pair *clear/unclear* by Égré and Bonnay (2010), but these authors do not consider any other adjectival predicates or the relation between non-symmetric indifference relations and the total/partial distinction.

with a couple of drops of water on it ($[\![\text{dry(b)}]\!]_X = 0$). *Dry* is a total adjective, so, by the Total axiom, it is possible for $a \sim_{dry}^X b$, i.e. for b to resemble a in terms of dryness. However, TA prohibits $b \sim_{dry}^X a$, i.e. this axiom prohibits a from resembling b with respect to dryness. Likewise, since b has some water on it ($[\![\text{wet(b)}]\!]_X = 1$) and a does not ($[\![\text{wet(a)}]\!]_X = 0$), and *wet* is a partial adjective, the Partial axiom prohibits $a \sim_{wet}^X b$ (i.e. b from resembling a), although $b \sim_{wet}^X a$ is still possible.

Furthermore, as discussed in section 2, non-scalar adjectives have both precise positive and negative forms. To account for this, I propose that indifference relations associated with NSs are subject to a pragmatic constraint that prohibit indifference relations from being established across the boundaries of their semantic denotations. This constraint, which I call *Be Precise*, is the conjunction of the total and partial axioms, and it is stated as in (53).

(53) **Be Precise (BP):**
For a non-scalar predicate S_1, a model M, and $a_1, a_2 \in D$,
1.If $[\![S_1(a_1)]\!]_{M,D} = 1$ and $[\![S_1(a_2)]\!]_{M,D} = 0$, then $a_2 \not\sim_{S_1}^X a_1$ in M, for all $X \subseteq D$.
2.If $[\![S_1(a_1)]\!]_{M,D} = 1$ and $[\![S_1(a_2)]\!]_{M,D} = 0$, then $a_1 \not\sim_{S_1}^X a_2$ in M, for all $X \subseteq D$.

The previous axioms made a distinction between the four subclasses of gradable predicates that were identified; however, the rest of the pragmatic axioms that I will propose will apply to all adjectival predicates in the same way. The first general axiom that I propose is called *tolerant convexity*[25]:

(54) **Tolerant Convexity (TC):** For all predicates P_1, all models M, all $X \subseteq D$, and all $a_1, a_2 \in X$,
- If $a_1 \sim_{P_1}^X a_2$ in M and there is some $a_3 \in X$ such that $a_1 \geq_{P_1}^t a_3 \geq_{P_1}^t a_2$ in M, then $a_1 \sim_{P_1}^X a_3$ in M.

Tolerant Convexity says that, if an object A is indistinguishable from an object B, and there is an object C lying in between A and B on the relevant tolerant scale, then A and C (the greater two of $\{A, B, C\}$) are also indistinguishable. For example, suppose I have two containers: one that has absolutely no liquid in it (i.e. is in the semantic denotation of *empty*), one with a very small amount of liquid, and then one which is a third-full of liquid. Although it might be conceivable that in some (extremely) large comparison class, I may consider the

[25]The definition of $\geq_P$ that is featured in the next two constraints is as follows: We first define an equivalence relation $\approx_P$:

Definition 4.6. ***Equivalent.*** *($\approx$) For a model M, a predicate P, $a_1, a_2 \in D$:*

1. $a_1 \approx_P a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M} = 0$ *and* $[\![a_2 >_P a_1]\!]_{X,M} = 0$.
2. $a_1 \approx_P^t a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M}^t = 0$ *and* $[\![a_2 >_P a_1]\!]_{X,M}^t = 0$.
3. $a_1 \approx_P^s a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M}^s = 0$ *and* $[\![a_2 >_P a_1]\!]_{X,M}^s = 0$.

Now we define $\geq_P$:

Definition 4.7. ***Greater than or equal.*** *($\geq$) For a model M, a predicate P, $a_1, a_2 \in D$:*

1. $a_1 \geq_P a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M} = 1$ *or* $a_1 \approx_P a_2$.
2. $a_1 \geq_P^t a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M}^t = 1$ *or* $a_1 \approx_P^t a_2$.
3. $a_1 \geq_P^s a_2$ *iff* $[\![a_1 >_P a_2]\!]_{X,M}^s = 1$ *or* $a_1 \approx_P^s a_2$.

third-full container to be indifferent from the completely empty container, I will never be able to do so while maintaining a distinction between the completely empty and almost empty container.

I propose a second axiom that is the correlate of TC: *Strict Convexity (SC):*

(55) **Strict Convexity (SC):** For all predicates P_1, all models M, all $X \subseteq D$, and all $a_1, a_2 \in X$,
- If $a_1 \sim^X_{P_1} a_2$ in M and there is some $a_3 \in X$ such that $a_1 \geq^s_{P_1} a_3 \geq^s_{P_1} a_2$ in M, then $a_3 \sim^X_{P_1} a_2$ in M.

Strict Convexity says that, if A is indistinguishable from B, and there is some C lying in between A and B on the relevant strict scale, then B and C (the lesser two of $\{A, B, C\}$) are also indistinguishable.

The next axiom deals with how indifference relations can change across comparison classes. At the moment, $\sim_P$s can be established and destroyed in different comparison classes in a more or less arbitrary way, provided that the previous three constraints are respected. But these constraints are still extremely weak, so presumably we might want some more restrictions on the distribution of the $\sim_P$s. I therefore propose the following axiom that specifies how distinctions can be made between individuals at different sizes of comparison classes:

(56) **Granularity (G):** For all predicates P_1, all models M, all $X \subseteq D$, and all $a_1, a_2 \in X$, if $a_1 \sim^X_{P_1} a_2$ in M, then for all $X' \subseteq D : X \subseteq X'$, $a_1 \sim^{X'}_{P_1} a_2$ in M.

Granularity says that if A and B are indistinguishable in comparison class X, then they are indistinguishable in all supersets of X. This is meant to reflect the fact that the larger the domain is (i.e. the larger the comparison class is), the more things can cluster together. In other words, the larger the comparison class is, the more it is possible to collapse fine distinctions that were made in smaller comparison classes, and once you collapse such a 'fine-grained' distinction, you cannot make it again at a more 'coarse-grained' level. With this axiom, we can see a connection between the proposal presented in this article and van Rooij's 2011c that was discussed in the previous section. Recall that, for van Rooij, the context-sensitivity of AAs was analyzed through variation between models based on the *refinement* relation. From the definition of *refinement* in (44), it is easy to prove a statement that looks almost identical to my statement of the convexity axioms[26]:

(57) **Fact (van Rooij, 2011c, p. 43):** M' is a refinement of M w.r.t. P ONLY IF for all $a_1, a_2, a_3 \in D$, if $a_1 \leq_P a_2 \leq_P a_3$ and $a_1 \sim_P a_3$ in M', then $a_1 \sim_P a_2$ and $a_2 \sim_P a_3$ in M.

[26]One must be cautious, however, with such comparisons based on the notation used. The relations that I notate using the $\sim^X_P$ expressions are slightly different than the relations notated by van Rooij's $\sim_P$: my $\sim^X_P$s are context-sensitive: they can change depending on comparison class and are stipulated as part of the model. Van Rooij's $\sim_P$s are not comparison-class dependent since they are defined based on the $>_P$ relations, which, as in this paper, are not context-dependent. In fact, van Rooij's $\sim_P$s are exactly my $\approx_P$s (def. 4.6); whereas, my $\sim^X_P$s notate different kinds of similarity relations which may not respect $>_P$. In other words, it is possible in my system for $a_1 >_P a_2$ and $a_1 \sim^X_P a_2$, but this is not permitted in van Rooij (2011c).

This result suggests that the analysis of the context-sensitivity of AAs that I am developing here is, in fact, also a theory context-sensitivity in terms of 'finegrained-ness', in the spirit of the proposals of Lewis and van Rooij.

While the previous three axioms talk about how indifference is preserved, the final two axioms deal with the preservation of differences across comparison classes.

(58) For all predicates P_1, models M, all $X \subseteq D$,

1. **Contrast Preservation (CP):** For all $X' \subseteq D$, and $a_1, a_2 \in X$, if $X \subset X'$ and $a_1 \not\sim^{X}_{P_1} a_2$ in M and $a_1 \sim^{X'}_{P_1} a_2$ in M , then $\exists a_3 \in X' - X : a_1 \not\sim^{X'}_{P_1} a_3$ in M .
2. **Minimal Difference (MD):** For all $a_1, a_2 \in D$, if $[\![a_1 >_{P_1} a_2]\!]_{M,X} = 1$, then $a_1 \not\sim^{\{x,y\}}_{P_1} a_2$ in M.

Minimal Difference says that, if, at the finest level of granularity, you would make a distinction between two individuals with respect to the semantic denotation of a predicate, then they are not indistinguishable at that level of granularity. MD is similar in spirit to van Benthem's *Downward Difference* because it allows us to preserve contrasts down to the smallest comparison classes. **Contrast Preservation** says that, if A and B are distinguishable in one CC, X, and then there's another CC, X', in which they are indistinguishable, then there is some individual C in X'-X that is distinguishable from A. For example, suppose I have two containers that, when we restrict our attention to them, we make a distinction between them in terms of *emptiness* (perhaps one is completely empty and one is almost empty). Then, suppose that in a larger CC, these two containers are now treated as indifferent. According to CP, this can only occur because of the introduction of a new container into the comparison class (perhaps a container with a very large amount of liquid) which is viewed as distinct from the other containers.

In summary, my analysis of the constraints on $\sim$ associated with scalar and non-scalar adjectives is given in table 1.

Axiom	**Relative**	**Total AA**	**Partial AA**	**Non-Scalar**
Reflexivity (R)	✓	✓	✓	✓
Tolerant Convexity (TC)	✓	✓	✓	✓
Strict Convexity (SC)	✓	✓	✓	✓
Granularity (G)	✓	✓	✓	✓
Minimal Difference (MD)	✓	✓	✓	✓
Contrast Preservation (CP)	✓	✓	✓	✓
Symmetry (S)	✓	×	×	✓
Total Axiom (TA)	×	✓	×	×
Partial Axiom (PA)	×	×	✓	×
Be Precise (BP)	×	×	×	✓

Table 1 – Axioms governing $\sim$ for (Non)Scalar Adjectives

The analyses of RAs, AAs and NSs presented in this section preserve the main lines of the Delineation approach to the semantics of (non)gradable constituents: adjectives are evaluated with respect to comparison classes, the denotations of predicates can vary across CCs (subject to certain constraints), and the denotation of the comparative is derived from the context-sensitivity of the positive form. Of course, this analysis has an important component that is not part of the basic delineation system: the $\sim_P$ relations, which are added to the model and create the tolerant and strict denotations. Thus, I highlight that, in this way, the DelTCS system constitutes a departure from the Klein-ian system. This being said, although the proposal presented in this article involves an extension of the classical DelS system, I argue that adding $\sim$ relations to the model has independent motivations that justify this extension, beyond allowing us to solve the puzzles associated with AAs that are the topic of this work in a simple and elegant manner. In particular, the introduction of such relations was proposed by Cobreros et al. (2012) to explain the Sorites susceptibility of vague relative adjectives and nouns, something that is distinct from the question of the 'hybrid' behaviour of AAs. Thus, the use of the $\sim$ relations in the analysis of AAs is just part of the analysis of the properties of vague language that I adopt. Furthermore, the existence of the $\sim_P$ relations in the model are, in principle, separate from questions of the (non)gradability of their associated predicates, although, as we will see in the next section, the proposals that I have made concerning their distribution will have certain pleasant consequences for the solutions to the gradability and scale structure puzzles discussed in section 2. I therefore conclude that the DelTCS system is a natural extension of the basic DelS system, one that simply incorporates information about cognitive similarity judgments, which is useful for the analysis of potential vagueness. In the rest of the section, we will see that this system is also useful for analyzing the context-sensitivity, gradability and scale structure properties of absolute predicates.

4.2 Solving the Four Puzzles

How does the analysis presented above solve the four puzzles that were identified in section 2? I will start by the context-sensitivity puzzle; that is, how can we account for the observation that the context-sensitivity of AAs is more restricted than that of RAs, without proposing that their meaning is completely context-independent? In the analysis given above (which is essentially a classical DelS analysis), relative adjectives are free to vary their semantic denotations across contexts, subject only to very weak ordering constraints such as van Benthem's. Since tolerant and strict denotations are built off these semantic denotations, and the $\sim$ relations associated with these predicates are reflexive, symmetric and subject again only to very weak constraints (cf. table 1), the two other semantic values assigned to RAs will also be context-sensitive. The semantic denotations of non-scalars, on the other hand, are proposed to be subject to the very strong AAA, which (correctly) renders their semantic denotation invariable across comparison classes. Furthermore, I proposed that the indifference relations associated with non-scalars satisfy the very strong constraint *Be Precise* (repeated in (59)).

(59) **Be Precise (BP):**
For a non-scalar predicate S_1, a model M, and $a_1, a_2 \in D$,
1.If $[\![S_1(a_1)]\!]_{M,D} = 1$ and $[\![S_1(a_2)]\!]_{M,D} = 0$, then $a_2 \not\sim^X_{S_1} a_1$ in M, for all $X \subseteq D$.
2.If $[\![S_1(a_1)]\!]_{M,D} = 1$ and $[\![S_1(a_2)]\!]_{M,D} = 0$, then $a_1 \not\sim^X_{S_1} a_2$ in M, for all $X \subseteq D$.

Since *Be Precise* prohibits indifference relations from being established across the boundaries of a NS S's semantic extension, S's tolerant and strict denotations are identical to its semantic denotation[27]. Therefore, contrary to RAs whose semantic, tolerant and strict denotations are all possibly highly context sensitive, none of the denotations assigned to NSs can vary across comparison classes. In my analysis, absolute scalar adjectives show a hybrid pattern: like NSs, both total and partial AAs are proposed to satisfy the AAA and, correspondingly, have a context-independent semantic denotation. Total adjectives are proposed to satisfy the *Total Axiom* (cf. table 1), which corresponds to the clause 1. in (59). This has the effect of rendering a total AA's **strict** denotation identical to its non-context-sensitive semantic denotation at every comparison class. However, no such strong constraints are put on the tolerant denotation of a total AA: for these predicates, the tolerant extensions are free to vary across comparison classes. Likewise, while the *Partial Axiom* makes the tolerant denotation of a partial AA identical to its classical semantic denotation, its strict denotation is not constrained in this way and can therefore change depending on comparison classes[28].

(60) **Context-Sensitivity Results**

a. Total absolute adjectives have a context-sensitive **tolerant** denotation, but a context-independent strict denotation.

b. Partial absolute adjectives have a context-sensitive **strict** denotation, but a context-independent tolerant denotation.

This being said, just because the tolerant (or strict) denotation of a total (or partial) AA is allowed to vary across some CCs, it does not mean that its context-sensitivity is completely unconstrained. For example, consider a total AA like *empty*. In principle, this predicate has three extensions: classical (i.e. semantic), tolerant and strict; however, thanks to the *Total Axiom*, its strict and classical extensions are the same, so, practically speaking, there are only two ways of interpreting the predicate: strictly/classically and tolerantly. When it is interpreted classically, it picks out only the individuals that are completely or exactly empty in every comparison class. When it is interpreted tolerantly, it picks out, in addition to the completely empty individuals, the individuals in the comparison class that are related to them by the $\sim_{empty}$ relation, i.e. those that are approximately empty. Therefore, while the tolerant extension of a total AA can change across comparison classes, its only locus of variation is between those individuals who are not completely empty, but may, in some context, be considered indifferent from completely empty individuals.

These facts make the empirical prediction that, no matter which way of interpreting the predicate that we choose, it will never be possible to use an AA to pick out individuals that do not lie at or close to the endpoint of its associated scale. Thus, we correctly predict that there should be a contrast between total AAs and RAs, whose denotations are not restricted in this way, in the definite description test. While *tall* can, in principle, be used to pick out (almost) any subset of the comparison class, *empty* can only be used to pick out completely empty or approximately empty individuals in the comparison class.

[27] This is proved in Burnett (2012). *Be Precise* being a pragmatic principle, I propose that, if the context is appropriate, it is possible for this constraint to be weakened or eliminated, resulting in 'loose' uses of non-scalars like Austin's *hexagonal*. In such cases, it will be possible to construct a tolerant or strict scale with the 'loose' NS, and thus we (correctly) predict that degree morphology with these predicates should become easier. See Burnett (2012) for discussion and a pragmatic theory of 'scalar coercion' of non-scalars.

[28] Again, these facts are proved more formally in Burnett (2012).

(61) Pass me the **tall/empty** one.

I now turn to the vagueness puzzle; that is, how can we account for the differences in potential vagueness between total and partial adjectives? The solution to this puzzle is quite straightforward: the *Total Axiom* prohibits members of the classical semantic extension of total AAs from being treated as indifferent from members of its anti-extension. Parallely, the *Partial Axiom* prohibits members of its classical anti-extension from being treated as indifferent from members of its extension, and, thus, it is predicted that establishing a Soritical series ending with members of the classical semantic denotation of *not straight* and *wet* should not be possible.

Of more interest is how the DelTCS analysis addresses the gradability puzzle; that is, if AAs have 'all or nothing' semantic denotations how can they be gradable?

Since we are working within a Delineation framework, as discussed in section 3, when we make proposals about context-sensitivity, we are also making proposals about gradability at the same time. Indeed, given that, in this framework, lack of context-sensitivity implies lack of gradability (Theorem 3.1), we correctly predict that (precise) non-scalar adjectives should be associated with no non-trivial scales, since none of their denotations are context-sensitive. The semantic denotations of relative adjectives, on the other hand, are associated with possible non-trivial strict weak orders; therefore we expect RAs to be gradable[29]. This being said, absolute adjectives show a different gradability pattern. As mentioned above, total AAs have context-sensitive tolerant denotations, while partial AAs have context-sensitive strict denotations. These denotations are free to vary across comparison classes constrained only by the axioms governing $\sim$ in table 1. Despite being very weak, these constraints have important consequences on the denotation of the tolerant or strict comparative relations associated with AAs. In particular, the scales that are associated with the tolerant denotations of total AAs and the strict denotations of partial AAs are possibly non-trivial strict weak orders. These results, which constitute the main formal results of this paper, are stated below and proved in the appendix to this article[30].

Theorem 4.1. *If Q is a total absolute adjective (i.e. subject to the AAA and the relevant constraints in table 1), $<^t_Q$ is a (possibly) non-trivial strict weak order.*
Theorem 4.2. *If R is a partial absolute adjective (i.e. subject to the AAA and the relevant constraints in table 1), $<^s_R$ is a (possibly) non-trivial strict weak order.*

My solution to the context-sensitivity/gradability paradox is therefore the following: absolute scalar adjectives have context-independent non-scalar semantic denotations, but context-sensitive, gradable tolerant or strict denotations.

Finally, I consider the scale structure puzzle, i.e. how can we account for the observation that, unlike RAs, which are associated with open scales, AAs are associated with scales that have either a top endpoint, a bottom endpoint or perhaps even two endpoints? Although it is true that, within a single finite domain, all scales associated with adjectival predicates

[29]Interestingly, it turns out that the comparative relations derived from both the tolerant and strict denotations of RAs ($>^t_P$s and $>^s_P$s) are not necessarily appropriate ordering relations. In particular, as shown in Burnett (2012), they are not even necessarily transitive. Therefore, we correctly predict that, despite having three context-sensitive extensions, RAs are only associated with a single usable scale.

[30]The appendix is available at `https://sites.google.com/site/heathersusanburnett/`.

(absolute or otherwise) will necessarily have both a top and a bottom endpoint, one way of expressing the 'infinite' nature of open and partially closed scales while looking only at finite domains is to think about how a scale in a particular domain associated with a scalar adjective P might be extended, should we add in other individuals[31]. If we extend the scale associated with P to include such individuals, some kinds of extensions may be blocked by the semantic (van Benthem's axioms for RAs; the AAA for AAs) or $\sim$-based axioms (TC, SC, Granularity etc.) that P obeys. Thus, we can provide Delineation compatible definitions of top-closed scales (i.e. scales with maximal elements), bottom-closed scales (i.e. scales with minimal elements) and open scales as in the following definitions:

Definition 4.8. ***Top-closed scale***. *For a predicate P in a model M, $>_P$ is a* top-closed scale *iff for all extensions of M, M', there is no $a_1 \in D_{M'} - D_M$ such that $a_1 >_P a_2$ in M', for $a_2 : \neg\exists a_3 : a_3 >_P a_2$ in M.*

In other words, we'll say that a scale in a model is *top-closed* just in case its maximal elements remain maximal under all extensions of the model.

Definition 4.9. ***Bottom-closed scale***. *For a predicate P in a model M, $>_P$ is a* bottom-closed scale *iff for all extensions of M, M', there is no $a_1 \in D_{M'} - D_M$ such that $a_2 >_P a_1$ in M', for $a_2 : \neg\exists a_3 : a_2 >_P a_3$ in M.*

Thus, we will say that a scale in a model is *bottom-closed* just in case its minimal elements remain minimal under all extensions of the model.

Definition 4.10. ***Open Scale***. *For a predicate P in a model M, $>_P$ is an* open scale *iff $>_P$ is neither top-closed nor bottom-closed in M.*

Finally, a scale will be *open* in a model just in case some extensions allow for new maximal members, and some extensions allow for new minimal members.

Using these definitions, we can show a further series of results concerning the properties of the non-trivial scales associated with gradable adjectives. Firstly, we can prove that being associated with scales that have endpoints is a consequence of membership in the absolute adjective class. We can note that the top endpoint of a predicate's tolerant scale is the predicate's semantic denotation.

Lemma 4.3. ***Total Top Endpoint***. *If Q is an absolute adjective (i.e. satisfies the AAA), all models M, and $a_2 \in D$ and $>^t_Q$ is non-empty,*

- $[\![Q(a_2)]\!]_D = 1$ *iff there is no $a_3 \in D$ such that $a_3 >^t_Q a_2$*[32].

In other words, we predict (correctly) that the elements that are at the top endpoint of the *empty/straight/clean* scale are those that are completely *empty/straight/clean*, since those are

[31] I thank Denis Bonnay for suggesting this strategy to me.

[32] Proof: $\Rightarrow$ Let $[\![Q(a_2)]\!]_D = 1$ and suppose there is some a_3 such that $a_3 >^t_Q a_2$. Then, there is some $X \subseteq D$ such that $[\![Q(a_3)]\!]^t_X = 1$ and $[\![Q(a_2)]\!]^t_X = 0$. But $[\![Q(a_2)]\!]_D = 1$, so by the AAA, $[\![Q(a_2)]\!]^t_X = 1$. $\perp$ $\Leftarrow$ Suppose there is no $a_3 \in D$ such that $a_3 >^t_Q a_2$ and suppose for a contradiction that $[\![Q(a_2)]\!]_D = 0$. Since $>^t_Q$ is non-empty, there is some a_4: $[\![Q(a_4)]\!]_X = 1$, for some $X \subseteq D$. By the AAA, $[\![Q(a_4)]\!]_D = 1$. So $a_4 >_Q a_2$. Now consider the CC $\{a_2, a_4\}$. By the AAA, $[\![Q(a_2)]\!]_{\{a_2,a_4\}} = 0$ and $[\![Q(a_4)]\!]_{\{a_2,a_4\}} = 1$. By MD, $a_4 \not\sim^{\{a_2,a_4\}}_Q a_2$. So $[\![Q(a_2)]\!]^t_{\{a_2,a_4\}} = 0$ and $[\![Q(a_4)]\!]^t_{\{a_2,a_4\}} = 1$, so $a_4 >^t_Q a_2$. $\perp$

the individuals that were proposed to be in the predicate's semantic denotation.

Now we show that, given the fact in lemma 4.3, an AA's tolerant scale ($>^t_Q$) is top closed (i.e. has a maximal element).

Theorem 4.4. *If Q is a total AA, then $>^t_Q$ is a top-closed scale*[33].

Secondly, we can show that the anti-extension of an absolute adjective is the bottom endpoint of its strict scale.

Lemma 4.5. ***Partial Bottom Endpoint***. *If Q is an absolute adjective (i.e. satisfies the AAA), all models M, and $a_2 \in D$ and $>^s_Q$ is non-empty,*

- $[\![Q(a_2)]\!]_D = 0$ *iff there is no $a_3 \in D$ such that $a_2 >^s_Q a_3$*[34].

In other words, the analysis correctly predicts that the minimal element of the non-trivial scale associated with a partial AA like *dirty/wet/bent* consists of those individuals that are not at all dirty/wet/bent, since those are the members of the predicate's semantic anti-extension.

Correspondingly, we can show that an AA's strict scale is a bottom closed scale:

Theorem 4.6. *If Q is a partial AA, then $>^s_Q$ is a bottom closed scale*[35].

Based on lemmas 4.3 and 4.5, we predict that the scales associated with total adjectives end at the same point where the scales associated with partial adjectives begin. This result replicates exactly a proposal made by Rotstein and Winter (2004) (p. 260) to account for the scale structure patterns discussed in section 2. We can note however that, while this coincidence between the endpoints of partial and total scales is part of Rotstein and Winter's 2004 main proposal, it is a consequence of the analysis of context-sensitivity and potential vagueness patterns developed in this work.

It was suggested in section 2 that there may be reasons to think that the class of total AAs should be divided into two subclasses: 'proper' total adjectives like *dry* and *straight*, which are only compatible with modifiers sensitive to scales with top endpoints, and 'fully closed scale'

[33] PROOF: Let M be a t-model and let $a_1 \in D_M$ such that there is no $a_2 \in D_M$ such that $a_2 >^t_Q a_1$ in M. Let M' be an extension of M such that $D_{M'} = D_M \cup \{a_3\}$. Show $a_3 \not>^t_Q a_1$ in M'. Suppose for a contradiction that $a_3 >^t_Q a_1$ in M'. Since there is no $a_2 \in D_M$ such that $a_2 >^t_Q a_1$, by lemma 4.3, $[\![Q(a_1)]\!]_{D,M} = 1$. Since M' is an extension of M, $[\![Q(a_1)]\!]_{D,M'} = 1$. Since $a_3 >^t_Q a_1$ in M', there is some comparison class $X \subseteq D \cup \{a_3\}$ such that $[\![Q(a_1)]\!]^t_{X,M'} = 0$. Since $[\![Q(a_1)]\!]^t_{X,M'} = 0$, $[\![\mathbf{Q(a_1)}]\!]_{\mathbf{X,M'}} = \mathbf{0}$. But, since Q satisfies the AAA and $[\![Q(a_1)]\!]_{D,M'} = 1$, $[\![\mathbf{Q(a_1)}]\!]_{\mathbf{X,M'}} = \mathbf{1}$. $\perp$

[34] PROOF: $\Rightarrow$ Suppose $[\![Q(a_2)]\!]_D = 0$ and suppose for a contradiction that there is some $a_3 \in D$ such that $a_2 >^s_Q a_3$. Then there is some $X \subseteq D$ such that $[\![Q(a_2)]\!]^s_X = 1$, so $[\![Q(a_2)]\!]_X = 1$. But since $[\![Q(a_2)]\!]_D = 0$ and Q satisfies the AAA, $[\![Q(a_2)]\!]_X = 1$. $\perp$ $\Leftarrow$ Suppose there is no $a_3 \in D$ such that $a_2 >^s_Q a_3$ and suppose for a contradiction that $[\![Q(a_2)]\!]_D = 1$. Since $>^s_Q$ is not empty, there is some $X \subseteq D$ such that $[\![Q(a_4)]\!]_X = 0$, for some $a_4 \in X$. By the AAA, $[\![Q(a_4)]\!]_D = 0$. So $a_2 >_Q a_4$. Now consider $\{a_2, a_4\} \subseteq D$. By the AAA, $[\![Q(a_2)]\!]_{\{a_2,a_4\}} = 1$ and $[\![Q(a_4)]\!]{\{a_2, a_4\}} = 0$. So by MD, $a_4 \not>^{\{a_2,a_4\}}_Q a_2$. So $a_2 >^s_Q a_4$. $\perp$

[35] PROOF: Let M be a t-model and let $a_1 \in D_M$ such that there is no $a_2 \in D_M$ such that $a_1 >^s_Q a_2$ in M. Let M' be an extension of M such that $D_{M'} = D_M \cup \{a_3\}$. Show $a_1 \not>^s_Q a_3$ in M'. Suppose for a contradiction that $a_1 >^s_Q a_3$ in M'. Since there is no $a_2 \in D_M$ such that $a_1 >^s_Q a_2$ in M, by lemma 4.5, $[\![Q(a_1)]\!]_{D,M} = 0$. Since M' is an extension of M, $[\![Q(a_1)]\!]_{D,M'} = 0$. Since $a_1 >^s_Q a_3$, there is some $X \subseteq D_M \cup \{a_3\}$ such that $[\![Q(a_1)]\!]^s_{X,M'} = 1$. Therefore, $[\![\mathbf{Q(a_1)}]\!]_{\mathbf{X,M'}} = \mathbf{1}$. However, since $[\![Q(a_1)]\!]_{D,M'} = 0$ and Q obeys the AAA, $[\![\mathbf{Q(a_1)}]\!]_{\mathbf{X,M'}} = \mathbf{0}$. $\perp$

adjectives, like *open* and *closed*, which are compatible with both top-closed and bottom-closed endpoints. It is easy to show that, based on the architecture of the framework, it is impossible for an adjective to be associated with an articulated scale that has both a top and bottom endpoint. Therefore, the DelTCS approach differs from the corresponding analysis within degree semantics in which such scales can be stipulated as part of the adjective's lexical meaning. Nevertheless, I suggest that we can still arrive at an appropriate analysis of this limited class of predicates within a Delineation system. One possibility is to propose that some fully-closed-scale absolute adjectives are subject to neither the Total nor the Partial axioms that create asymmetries between absolute predicates and their negations. This would have the consequence that these predicates could be associated with **two** non-trivial scales: a top-closed tolerant scale and a bottom-closed strict scale. This analysis is particularly appealing for predicates like *open*, where it is possible to find a single basic semantic denotation (for example, the set of objects having some degree of aperture) that would constitute the top endpoint of a tolerant scale and whose complement would constitute the bottom endpoint of a strict scale (62).

(62) a. The door is almost open. ⇒ The door is not open.
b. The door is slightly open. ⇒ The door is open.

Another possibility is to propose that certain other fully-closed-scale adjectives are in fact ambiguous between a total (i.e. universal) version and a partial (i.e. existential) version. Such an analysis is appealing for predicates like *closed*, where the semantic denotation of the total predicate *closed*$_1$ would pick out those objects that are completely closed and be associated with an articulated top-closed tolerant scale (63-a) and the semantic denotation of the partial predicate *closed*$_2$ would pick out those objects that have some amount of closure and be associated with an articulated bottom-closed strict scale (63-b).

(63) a. The door is almost closed.
b. The door is slightly closed.

However, I leave the question of how one or both of these styles of analyses should be applied to the complete list of "fully-closed-scale" adjectives to future research.

Finally, I turn to the scale structure of relative adjectives. In section 3, it was proposed that RAs were only subject to van Benthem's axioms (No Reversal, Upward Difference, and Downward Difference). These conditions are very weak (they just ensure a strict weak ordering), and, as such, very many more models will be models for RAs than for AAs. Thus, the scales built from the semantic denotations of RAs ($>_P$s), which are the only non-trivial strict weak orders associated with these predicates, will permit extensions where their maximal and minimal elements do not remain maximal/minimal. In other words, relative semantic scales are open scales: they have no non-accidental endpoints.

Theorem 4.7. *If P is a relative adjective, then $>_P$ is an open scale*[36].

[36] PROOF: **(Not Top Closed:)** Let M be a model and let $a_1 \in D_M$ such that there is no $a_2 \in D_M$ such that $a_2 >_P a_1$. Now consider the proper extension, M', such that $D_{M'} = D_M \cup \{a_3\}$. Suppose that $[\![P(a_3)]\!]_{\{x,y\}} = 1$ and $[\![P(a_1)]\!]_{\{x,y\}} = 0$. This is permitted (provided P still satisfies NR, UD, and DD) because $[\![P]\!]$ can vary

We therefore correctly predict that RAs should pass neither the tests for having a maximal element nor the tests for having a minimal element.

I therefore conclude that the analysis presented in this paper provides novel and satisfying answers to the four puzzles raised by the context-sensitivity, vagueness and gradability properties of absolute scalar adjectives for Delineation Semantics.

5 Conclusion

In this paper, I proposed a new analysis of the semantic and pragmatic properties of absolute scalar adjectives and their similarities and differences to relative adjectives on the one hand and non-scalar predicates on the other. This analysis was set within a new logical framework, *Delineation TCS*, which I developed in order to model the relationships between the phenomena of context-sensitivity, vagueness and scale structure in the adjectival domain. I argued that this analysis of absolute scalar adjectives manages to capture certain aspects of the meaning of these predicates that have been argued to be problematic for the Delineation approach to the semantics of gradable predicates. I argued that the puzzles raised by absolute adjectives for a theory of vagueness and comparison can be solved within a context-sensitivity-based framework, provided that we have an appropriate account of the puzzling features of vague language. Finally, I have shown that the scale-structure properties that have traditionally been the exclusive domain of degree semantics can arise naturally from certain intuitive statements about how individuals can and cannot be indifferent across comparison classes.

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across CCs. So $a_3 >_P a_1$. **(Not Bottom Closed:)** Let M be a model and let $a_1 \in D_M$ such that there is no $a_2 \in D_M$ such that $a_1 >_P a_2$. Now consider the proper extension of M, M', such that $D_{M'} = D_M \cup \{a_3\}$. Suppose $[\![P(a_1)]\!]_{\{x,y\}} = 1$ and $[\![P(a_3)]\!]_{\{x,y\}} = 0$. So $a_1 >_P a_3$. □

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