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## Situations and Modality in Predicative Modal Superlatives

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### Abstract:

Predicative modal superlatives, such as Italian *Luisa è stata il più calma possibile* ('Luisa was the most unperturbed possible'), state that the highest amount of calm that could be instantiated in the type of situation at hand, was associated with Luisa in the actual world. The semantic strategy proposed for tracking situations of the relevant type across worlds and varying individuals builds on the assumption that the modal adjective projects a predicate ( $Q$ ) that captures specific circumstances affecting individuals that do not necessarily have a counterpart in all worlds, and that such circumstances cannot therefore be included in a standard modal base. The analysis verifies a relation between Luisa and a particular amount  $q$  in the real world  $w$  under some specific circumstances, and checks that for all amounts  $q'$  and accessible worlds  $w'$ , if there is an individual holding the same relation to  $q'$  in  $w'$  and under the same circumstances, then  $q' \leq q$ .

Keywords: *Modality, Predicative Modal Superlatives, Semantics, Situations*

### 1. Introduction

Predicative modal superlatives (1) differ from ordinary superlatives (2) at least insofar as the entity that is ranked highest according to the relevant gradable property is not necessarily the only one to occupy that position.

- (1) Luisa è stata (il) più calma possibile  
'Luisa was the most unperturbed possible'
- (2) Luisa è stata la più calma  
'Luisa was the most unperturbed'

Narrowing down the relevant alternatives is crucial, given that the amount of the gradable property is not necessarily the

all-times maximum for the individual considered, and that the individual is not unique. Such narrowing is done too systematically to be just a contextual effect. We propose a way to restrict the alternatives in the class of comparison in predicative modal superlatives. The modal adjective is assumed to project a predicate ( $Q$ ) that makes it possible to express specific circumstances that affect individuals that do not necessarily have a counterpart in all worlds, and thus cannot be included in the modal base. Other than that, individuals and worlds can vary independently. This semantic analysis verifies for (1) a relation between Luisa and a particular amount  $q$  in  $w$  under some specific circumstances restricted by  $Q$ , and checks that for all  $q'$  and accessible  $w'$ , if there is an individual holding the same relation to  $q'$  in  $w'$  and under the same circumstances, then  $q' \leq q$ .

The paper is organised as follows. Section 2 outlines the main semantic characteristics of the interpretation of modal superlatives and positions it in the landscape of readings of ordinary superlatives. The issue of how to restrict the domain of the alternatives considered in the comparison is tackled in section 3. A way to connect the so-called equative reading with the presence of a modal is explored, and the predicate  $Q$  that selects the type of situation to be verified in the words is introduced and motivated. Section 4 develops a formal proposal for the comparison class used in predicative modal superlatives. While the comparison classes vary due to the superlative readings, the superlative operator remains unchanged, modulo semantic type adjustments. In the last part of the section, the properties of the proposed analysis are explored in more detail by testing it with a number of scenarios. In particular, it is considered how the restriction of the comparison class should be achieved in these cases and the consequence on the truth conditions. Section 5 concludes the paper with some considerations on the modality of the adjective in modal superlatives.

## 2. Peculiarities of modal superlatives

A ‘modal superlative’ is a sentence with superlative morphosyntax, a modal adjective, and the so-called equative reading. In this section, it will be seen that the three indicated components are all required to yield the interpretation we are interested in.

### 2.1 Three components for the modal superlative reading

The term superlative morphology has to be taken in a broad sense, recall that Romance languages do not have a dedicated operator like *-est* in English. Basic components for superlatives in Romance are comparative morphology, definite articles, and syntactic conditions. We refer the reader to Giurgea (2022), Dobrovie-Sorin (2022) on this complex issue. See also Dobrovie-Sorin and Tovina (2022) for a recent assessment of the ongoing debate.

Larson (2000) has shown that a sentence with the combination of superlative morphology and modal adjective is potentially ambiguous. It is possible to interpret the superlative in (3) as an ordinary one and to assign it an absolute reading. This interpretation meets the uniqueness constraint, and the modal adjective is taken to be a modifier of the noun. The paraphrase Larson provides is something like (3a). In addition, (3) can also be interpreted as containing a modal superlative, and be paraphrased as in (3b), whose reading is equative with respect to the girls.

- (3) Don tried to hire the kindest girl possible
- a. Don tried to hire the kindest  $x$  such that  $x$  is possibly a girl
  - b. Don tried to hire as kind a girl as it was possible for him/one to hire
- (4) Alex tried to hire the tallest possible players

Although Larson's example (3) with the modal adjective in postnominal position has sometimes been challenged, other examples of his with the modal in prenominal position are broadly accepted, such as (4) that he does not analyse in details. Larson does not discuss predicative modal superlatives. The prenominal vs. postnominal position of the modal adjective is a debated issue for English, but does not seem to be relevant for Italian, where the adjective *possibile* is ordered after the superlative marked adjective, and where there would be no nominal head in the predicative superlative phrase (Loccioni 2018).

Larson associates each reading of (4) with a specific syntactic structure, while acknowledging that the modal adjective is lexically restricted almost only to *possible*, and Romero (2013) concurs. In minimal terms, the adjective is an existential modal without intrinsic special colouring (circumstantial, deontic, etc.). An analogous situation is found in various languages that have modal superlatives.

Not in all languages are modal superlatives as natural as claimed for English. For example, in Italian modal superlatives such as (1) are not accepted by all speakers.<sup>1</sup> Certainly, there are sentences that contain superlative morphology and a modal adjective, but they may not qualify as modal superlatives. For instance, consider (5), that is broadly accepted by native speakers of Italian, much more easily so than (1), as revealed by the informal survey we conducted on a group of about ten speakers.

- (5) Il Pendolino è il treno più veloce possibile  
'Pendolino is the fastest existing train'

Sentence (5) and the like are not modal superlatives, though. To establish where the difference lies, note that the available reading is the absolute ordinary superlative, namely a uniqueness constraint is imposed on the referent of the superlative phrase. There is a unique individual – more precisely a unique type of trains in (5) – that satisfies the property of being fast to a higher degree than all others. That degree of speed holds for that (type of) individual in the actual world. Likewise, it is in the actual world that the degree of speed of alternative individuals is verified. Possible means possible in the actual world, which means existing. The so-called equative reading, discussed shortly, is not available, and the modal does not give access to worlds other than the real one. Next, (5) and (1) differ in the presence of a nominal head in the superlative phrase that imposes a restriction on the entities that are compared. As Loccioni (2018) has shown, no (c)overtnoun can be assumed in predicative modal superlatives in Italian, see her example (6). This second peculiarity and the properties of the definite article – which in (6) and (1) is optional and does not agree – will not be discussed in this paper.

- (6) Lenuccia è il più gentile possibile  
'Lenuccia is the kindest possible'

The third relevant component is the so-called equative reading. Example (1) can be paraphrased as 'Luisa kept as much calm as possible', an interpretation labelled 'equative' in the literature (Larson 2000; Schwarz 2005; Romero 2013; Loccioni 2019). Unlike ordinary superlatives, modal superlatives do not identify an entity in a group as the one that uniquely

<sup>1</sup> The issue is made more complex by the existence of idiolects with opposing preferences. Our reviewers expressed equally categorical and completely opposite views on the obligatory presence or absence of the definite article for the modal reading of (1).

shows the highest degree of a quality either because i) it directly displays the quality, e.g. being a mountain and comparing the height of mountains in the absolute reading of (7), with unicity, see the contrast between (8) and (9), or ii) it shows a derived quality, e.g. being a mountain climber and associating them with the height of the mountains they climbed in the relative reading of (7). Intuitively, the equative reading in modal superlatives comes out from comparing amounts of a gradable quality. The uniqueness of the amount does not correlate with the uniqueness of the individual associated with that amount.

(7) Louise climbed the highest mountain

Luisa in (1) is not what Farkas and Kiss (2000) call the correlate of a relative superlative. The modal superlative does not distinguish from the others that particular member of a set of girls that has the highest degree of a property, see the acceptability of (8).

(8) Luisa è stata il più gentile possibile, così come Maria  
'Luisa was the kindest possible, as was Maria'

Recall that a similar form of non-uniqueness of the individual associated with the top value is not possible with ordinary superlative, see the marginality of (9).

(9) ?\*Luisa è la più gentile, tanto quanto Maria  
'Luisa is the kindest, as much as Maria'

The first conclusion is that not any modal adjective in a superlative DP suffice to yield a modal superlative interpretation, and the use of *possibile* in a superlative does not secure the availability of the reading straightforwardly. The modal superlative distinguishes the unique higher amount of the gradable property that is realised in context, the reading is equative only relative to individuals. For this reason, we refer to it as so-called equative.

## 2.2 Comparing the modal superlative reading with those of ordinary superlatives

A point of similarity between the absolute superlative reading and the modal superlative reading, concerns the association with the gradable property described by the adjective. In both cases, and unlike the case of the relative superlative, the relevant entity is directly associated with an amount of the gradable property under discussion. Mountains are high in (7), and Luisa is calm in (1). An important semantic difference is that the individuals that are compared in the modal superlative interpretation need not belong to the same world, unlike what is the case in the absolute reading of ordinary superlatives.

As for the relative reading of ordinary superlatives, a point of similarity between it and modal superlatives concerns the possible use of an intensional property to characterise the alternatives in the comparison class. The intensional characterisation of degree sets is useful to make the correlate (Farkas and Kiss 2000) play a role (Heim 1999, and subsequent work). Sets of degrees are identified via the 'quantitative' information related to the degree and the 'qualitative' information about who instantiates that quantity. The correlate instantiates the degree in a particular eventuality (state or event), and the property of degrees must contain information that captures how it participates in the eventuality. Thus, the verb of the clause contributes to the definition of the intensional property and so does the wording of the property, which may

be understood as providing a sort of theta information. The world scopes high. The quantity information makes the ordering possible, no order is directly based on individuals. In semantic terms, it could be said that intensions are used in the analysis of ordinary superlatives not to bring worlds into the picture per se, but in order to enrich the content of the expression used to characterise sets of degrees. The net result is that degree properties (intensions) allow one to avoid ties due to identical extensions (Howard 2014). Note that in the relative reading, similarly to what holds for the absolute one, all the individuals that are compared belong to the same world, namely the real world. It should also be noted that these analyses do not mention how worlds are restricted. In short, this style of analysis brings in worlds but seems to have no specific use for them. This is in stark contrast with what goes on in modal superlatives, where the individuals that are compared do not necessarily belong to the same world.

The use of intension for ordinary superlatives is not without consequences, as Howard (2014) points out. The fact that Howard, among other scholars, distinguishes sets of degree (extensions) via degree properties (intensions) creates problems for him with modal superlatives, where ties among alternatives are admitted/recorded. In the case of modal superlatives, his analysis would predict the correct truth conditions only under the assumption that the superlative operator *-est* is quantifying over degree sets (extensions), not degree properties (intensions), as he acknowledges himself. Consider (10), and the degree sets in (11), which are identical. If *-est* could distinguish between them, then the predicted truth conditions would be impossibly strong: “There is no other possible world where John climbed as many mountains as he did in  $w@$ ”.

- (10) John climbed the most possible mountains  
 There is no accessible world where J. climbed more mountains than he climbed in  $w@$
- (11) a.  $\lambda d$ . John climbed  $d$ -many mountains in  $w_1$   
 b.  $\lambda d$ . John climbed  $d$ -many mountains in  $w@$

The second conclusion we can draw in this section is that the availability of the so-called equative reading is distinctive of modal superlatives and is apparently connected with the presence of some form of modality. The individuals that are compared need not necessarily belong to the same world, contrary to the absolute and relative readings of ordinary superlatives. This prompts the questions of what type of connection is at play and what is the relevant form of modality. The literature on modal superlatives (Larson 2000; Schwarz 2005; Romero 2013; Loccioni 2019) seem to take for granted that *possible* is run-of-the-mill modality. As a matter of fact, they either underestimate the treatment of modality that is required by these superlatives and dismiss it as a question of defining the relevant modal base (Romero 2013; Loccioni 2019), or are silent about it (Schwarz 2005).

### 3. Situations and modality in predicative modal superlatives

As seen above, modal superlatives do not singularise a particular individual by attributing to them a higher degree of a property than the other members of a certain group. The comparison is not constructed from a specific individual, which does not detract from the fact that conditions are used in exploring the space of alternatives. This section focuses on the question of how restrictions are applied, and this is where modality kicks in.

### 3.1 *Forms of homogeneity that restrict predicative modal superlatives*

A first type of restriction concerns the individual variable. There is a form of homogeneity constraining the individual who can instantiate the argument of the adjective that goes beyond pragmatic relevance. This is close to the effect obtained by the consistent application of a predicate across worlds. Yet, this is not done (or not only) through a (c)overt noun that restricts the individual, which is said not to be available in Italian (Loccioni 2018), see (12).

- (12) a. \*Luisa è restata la persona più calma possibile Luisa kept the calmest person possible  
 b. \*Luisa è restata la più calma persona possibile

A second form of restriction concerns situations. The superlative in (1) is about the amount of calm considered, which is ordered regardless of who displays it in the accessible worlds. Like for individuals, there is a homogeneity condition restricting the type of situation. This can be expressed overtly via a modifier, see (13).

- (13) Luisa è restata (il) più calma possibile in quel frangente  
 ‘Luisa was as calm as possible in that juncture’

An available interpretation for (13) implies that in other situations the amount might well have been superior – see the explicitly concessive flavour of (14) – while asserting that the actual amount was the maximal one under the circumstances.

- (14) Non sarà sembrata particolarmente calma, ma ad essere sinceri, è stata il più calma possibile  
 ‘She may not have seemed particularly calm, but to be honest, she was the calmest possible’

A restriction can also be provided by mentioning other participants in the situation, e.g. by mentioning the customer in (15).

- (15) Dato il cliente difficile, Luisa è stata il più gentile possibile.  
 ‘Given the difficult customer, Luisa was the kindest possible’

In short, there is a condition on the individual and a condition on the situation, and the two are visible to each other. This is going to be captured by positing a predicate that constrains them both. It is worth underscoring that a reason why it is unsatisfactory to merely assume a form of contextual restriction is that such restrictions are used in the formalisation to select the relevant worlds among those that are accessible, and thus must be made explicit to perform that task consistently.

### 3.2 *Situations and modality*

Individuals play a prominent role in ordinary superlatives, and they are considered within the same world. In predicative modal superlatives, individuals and worlds can vary and the values for their variables are defined without one necessarily depending on the other. Amounts contribute information for the construction of equivalence classes of individual and world pairs, anticipating

on subsection 4.1 below. The successful semantic analysis has to be able to restrict the alternatives in the class of comparison in predicative modal superlatives, while getting the right truth conditions.

When speaking of restrictions, it is natural to first consider whether there are any and what linguistic material expresses them. Overt restrictors for individuals and situations are virtually non-existent in (1), which makes the syntactic option of reconstructing lexical material from outside the superlative phrase, as proposed by Larson (2000), Romero (2013), and Loccioni (2019), uninteresting for this type of sentence. For instance, Romero's syntactic raising analysis with ACD rests on the assumption that the predicative DP contains a trace whose antecedent is deleted but provides a restriction for the comparison class. However, typical cases such as (1) are simple copular sentences where the only possible antecedent is the copular sentence itself.

As for the semantic side, in a nutshell, Romero proposes to build the comparison class in two steps: i) go through all the possible worlds and extract the set of degrees which makes true the degree predicate expressed by the sentence, and ii) apply a shifting function on each extracted degree in order to get an abstract degree predicate of the expected type. The set of these degree predicates constitutes the comparison class to which the degree predicate expressed by the sentence is compared to in the real world. Let's consider example (16), which contains a quantity superlative.

(16) John climbed the most possible mountains.

Romero's analysis applied to example (16) exploits downward monotonic degree predicates<sup>2</sup> of the form  $\lambda d[\exists x[*mount(x) \wedge climb(j,x) \wedge |x| \geq d]]$ , i.e. the set of degrees  $d$  such that John climbed at least  $d$  mountains. The logical form of the sentence is [-est [1 possible <for John(/him) to climb A  $t_1$ -high mountain>]] [2 John climbed A  $t_2$ -high mountain]. The first argument of the superlative operator -est is obtained by the ACD mechanism and gives rise to the comparison class. More precisely, a set is made of all the degrees  $d$  verifying the predicate in possible worlds. Then a shifting function transforms each degree in this set into a downward monotonic degree predicate, in order to constitute the comparison class of degree predicates. The degree predicate in the second argument of the superlative operator -est, i.e. the predicate  $\lambda d[\exists x[*mount(x) \wedge climb(j,x) \wedge |x| \geq d]]$ , is compared to the degree predicates in the comparison class: there exists a degree  $d$  such that this degree predicate is true at  $d$  and all the other degree predicates in the comparison class are false at  $d$ . Note that the starting point of this analysis is a set of possible worlds determined by the context. Their selection is not clearly explained, and we observe that no progress has been made on the precise way of selecting the types of situations to be considered. Moreover, the role of the type shifting function is only to get the expected semantic type of objects that constitutes the comparison class and to make the proposition work, without further motivation.

Also of reduced interest is a pragmatic option analogous to assuming that the collection of relevant alternatives is provided by the context, e.g. via the focus operator as proposed by Heim (1999) and followers. Note that focus is compatible with a predicative modal superlative, but it does not bring in the alternatives for the modal superlative. Example (17) is understood as saying that Luisa is the one who did her best to be kind, the others did not really try. It doesn't mean that everyone tried, and she is the one who did the best, among the set of individuals determined by the focus, a reading close to a relative superlative interpretation where *Luisa* would be playing the role of correlate.

<sup>2</sup>A downward monotonic degree predicate is a degree predicate of the form  $\lambda d[X(d)]$  such that if  $X(d)$  is true then  $X(d')$  is also true for all  $d'$  smaller than  $d$ .

- (17) LUISA è stata il più gentile possibile  
 ‘LUISA was the kindest possible’

The risk for a pragmatic option is to put too much into ‘relevant in context’ and understand it a little too much as a synonym for homogeneous. One can easily imagine a scenario where different individuals are relevant for different contextually valid reasons, but such a potential dishomogeneity is not tolerated in modal superlatives. Incidentally, the subject is not focussed in (1), and there are no other licensing operators among those identified by Farkas and Kiss (2000) for the relative reading of ordinary superlatives.<sup>3</sup>

This leads us to explore a semantic option for restricting the class of comparison and capturing the consistency of the situations considered across accessible worlds. Obvious candidates for the task are the modal base and what can be expressed via the accessibility relation (*Acc*), and/or a predicate constraining the type of situation (*Q*), used in characterising the class of comparison, and verified in the accessible worlds. These options have been unevenly used in previous analyses.

Loccioni (2019) is practically silent on the modal  $\diamond$  and the accessibility function, but the solution of assuming a circumstantial base and just the relevant situations in which Luisa finds herself (without other individuals being considered), as she seems to do, only models one particular reading. As a matter of fact, it is not certain that there is a reading of the predicative modal superlative in Italian where an individual is compared exclusively to herself, without such self-referentiality being an accidental contingent fact. In any case, it is not available to all speakers who nevertheless have modal readings. In what follows, we discuss it anyway, because it seems accessible to some speakers, including a reviewer, or in some languages. We are interested in showing how our proposal would be able to handle it, if it ever existed and was not blocked by factors yet to be defined. So, assume with Loccioni (2019) that sentence (1) can be interpreted in this particular way. Let’s imagine that Luisa gets carried away easily or that she was particularly on edge that day. Let’s suppose she managed to control herself when faced with a difficult customer. In this context, by uttering the sentence *Luisa è stata il più calma possibile* (1), the speaker can express the fact that Luisa was calm to at least as great a degree as she could have achieved in similar circumstances, given her temperament or mood. The calmness of individuals other than Luisa is not taken into account in this comparison. If a colleague of Luisa is calmer than she is, then this does not change the truth value of the sentence. In this particular reading, some of the characteristics of Luisa and the situation she finds herself in could be translated within a circumstantial modal base, in the form of propositions such as “Luisa gets carried away easily” and “Luisa is faced with a difficult customer”.<sup>4</sup>

But there is another interpretation of the sentence (1), where the calm Luisa shows in the real world is not compared to the calm she would show in a similar situation, but to the calm any individual (sharing with Luisa some common characteristics) would show in a similar situation. In this reading, the sentence in (1) can be used to express the fact that Luisa is at least as calm as any shop assistant faced with a difficult customer. It’s true that the context

<sup>3</sup> Focus, interrogative operators, and relative wh-phrases, all help to get at the alternatives that are the members of the comparison class. The observation that focus in (17) fails to contribute alternatives for the modal superlative could be an indication against a raising style analysis with ACD, a line to be explored in the future.

<sup>4</sup> Although we are not interested in this particular reading here, we will show that we can adapt the semantics proposed in this article to this particular case. What will change is not the superlative operator itself but the construction of the comparison class, which will be based on individual-world pairs in which the individual is constant and coincides with Luisa (or her counterparts in the possible worlds).



gives us some general information about the individuals being compared. For example, they are not Buddhist monks (known for their legendary calm), but shop assistants faced with a difficult customer, and this has an impact on the truth value of the sentence. The problem is that information about these individuals cannot be encoded in the form of propositions in a circumstantial modal base. Intuitively, such information would take the form of a formula such as “ $x$  is a shop assistant faced with a difficult customer”, to be evaluated for a certain  $x$  in a possible world, which is not the usual way of using a modal base. Moreover, it may be that certain individuals  $x$  in certain possible worlds have no counterpart in the real world. However, the propositions within a circumstantial modal base are true propositions in all the accessible worlds, in particular in the real world.

The description of the situation extended to other undefined or not (fully) defined individuals cannot technically constitute a usual modal base, because of the remaining undefined part, as explained shortly. We need a situation type that allows for the selection of situations in accessible worlds. Similarly, Romero (2013) does not say how adding propositions to the modal base would get her the restriction effect that is needed.

Let’s clarify why the ordinary treatment of modality is not enough for restricting the alternatives in the comparison class of predicative modal superlatives. Consider Luisa and sentence (1), sticking to the scenario where she is a shop assistant. The superlative expresses a comparison of Luisa’s amount of kindness with the amounts of kindness of other individuals  $x'$  in possible worlds. The pairs of individuals and worlds ( $w', x'$ ) represent the alternatives to Luisa in the real world. The comparison class itself is constructed from these alternatives, see subsection 4.1. An obvious way to restrict these alternatives is to restrict the worlds using a modal base. Recall that a modal base is a set of propositions that restricts the possible worlds in which a proposition is evaluated. Its modal colour (circumstantial, deontic, etc.) is given by the propositions that compose it, e.g. the scene takes place in a shop, or employees must comply with a minimum set of rules, etc. But these propositions make it difficult to select individuals  $x'$  within accessible worlds. A proposition of the modal base that would only concern Luisa would bring no restriction on individuals  $x'$  in worlds  $w'$ . Conversely, a proposition that would concern all individuals without distinction would give rise to too strong a restriction. For example, a proposition of the modal base that would impose that every individual is a shop assistant would give rise to worlds populated only by shop assistants. It might be tempting to consider propositions with a more complex form, e.g. a conditional, such as “if an individual is a shop assistant, then they has such-and-such a property”, but this also does not allow one to select the individuals  $x'$ . Next, some of the individuals  $x'$  may not belong to all the accessible worlds and may not necessarily have a counterpart in the real world. Some characteristics of such  $x'$  are undetermined and do not allow the modal base to perform a restriction on  $x'$ . The use of an ordering source in addition to the modal base does not help, as the selection made by the ordering source is also based on a set of propositions. The order defined by the ordering source does not change this.

The information that allows the selection of individuals  $x'$  is not a set of propositions (the modal base) but information about the situation in which  $x'$  is found in the possible world  $w'$ . What is evaluated is not a simple proposition, as in the case of the usual modality, but a predicate about  $x'$  and  $q'$  in the world  $w'$ , which can be expressed with a predicate  $Q$  in the form  $Q(w')(x')(q')$ . The individuals  $x'$  in the accessible worlds  $w'$  are indirectly selected through  $Q$ , e.g.  $x'$  is a shop assistant and  $x'$  is in a situation where  $s/he$  is confronted with a difficult customer, etc. The specification of this type of situation is an enrichment of the explicit content of the sentence. This enrichment comes from the context and can, to some extent, be made explicit as in (13)-(15).

We now have two types of restriction, one on the possible worlds – given by the modal base – and one on the type of situation, and the two cannot be combined as by intersection of propositions or conjunction of predicates. However, since the  $x'$  selected by the predicate  $Q$  belong to the  $w'$  worlds selected by the modal base, the restriction of the ones induces a restriction of the others. The predicate  $Q$  is applied uniformly across the possible worlds and expresses homogeneity of the situations in the worlds  $w'$ , and of the individuals  $x'$ .

Let us assume that a situation in a world is (merely) a part of this world (Barwise and Perry 1980, and subsequent work), just as an event in a world is a part of the world, implying a temporal dimension.  $Q$  is applied to an individual  $x'$ , an amount  $q'$ , in a world  $w'$ , and describes a situation involving these three components.  $Q$  is a predication extracted from the linguistic material of the sentence, with an attribution of an amount  $q'$  to  $x'$  in the world  $w'$ , namely  $x'$  was  $q'$ -calm in the world  $w'$ , (which is the minimum that  $Q$  is asked to do). But that is not all. It also contributes to describe additional features that constitute the right content of the situation and engage  $x'$  in the world  $w'$ , e.g. there is a certain unpleasant person opposite  $x'$ .<sup>5</sup>

A crucial and surprisingly new issue in the discussion on modal superlatives is what the modal *possibile* expresses in these sentences. It could express only the accessibility of possible worlds, i.e. worlds compatible with circumstances, obligations, etc., or also the type of situation. The former option has been widely adopted tacitly in the literature, and we have shown that is not viable on its own, insofar as accessibility (*Acc*) is not sufficient. On closer inspection, two matters can be separated, namely the need to add other conditions besides accessibility, and the need to establish what these conditions are and how they are added. According to the line sketched in this section, the modal adjective would encapsulate both accessibility (*Acc*) and the type of situation ( $Q$ ), which would result in a kind of mixed modal operator. This line raises important issues related to the interface with syntax that call for further research. The focus of this paper is on working out what are the additional semantic conditions minimally required.

#### 4. Building the superlative

##### 4.1 Each superlative has its type of comparison class

In general terms, the comparison class of a superlative can be taken to be a set of entities  $C$  compared to one of its members  $c$ , such that  $c$  is distinguished from the other entities of  $C$  with respect to some measurement property. Moreover, these entities are obtained by abstraction from the semantic content of the sentence. In order to better appreciate this notion, let us first consider the ordinary superlative in (7). In its absolute reading, the comparison class corresponds to the denotation of the head noun. A mountain in such a set exceeds the others in terms of a height property. In its relative reading, the comparison class is a contextually relevant set of individuals who have each climbed one or more mountains, in a simplified analysis.<sup>6</sup> Louise stands out from the other individuals in the comparison class in terms of a height property, in

<sup>5</sup>The careful reader will have noticed the different nature of the contextually relevant  $Q$  assumed in the analysis and  $C$  assumed in (Heim 1999). It is not an object with an extension in the actual world, rather it is a predicate that allows one to filter out the individuals and worlds that constitute possible alternatives.

<sup>6</sup>As mentioned in subsection 2.2, in some analyses, the elements of the comparison class of a relative superlative are defined in a more abstract way as predicates of degree or 'intensionalised' predicates of degree of the form  $\lambda w \lambda d [x'$  climbed a  $d$ -high mountain in the world  $w$ ] (Heim 1999; Matushansky 2008, and others).

the sense that the height of a mountain climbed by Louise is greater than the height of mountains climbed by the other individuals in the comparison class.

Let us now consider predicative modal superlatives. We have proposed in subsection 3.2 that the amounts of the gradable property that are compared in a modal superlative do not characterise specific individuals, rather they are associated with individuals and worlds pairs. In order to build the comparison class, we start by considering the set of pairs  $(w', x')$  that provides the collection potentially to be compared, namely  $S$  in (18). Set  $S$  is constructed by going through all individuals  $x'$  in all accessible worlds  $w'$  such that  $x'$  and  $w'$  verify the predicate  $Q$  for some amount  $q'$ .

$$(18) \quad S = \lambda x' \lambda w' [\exists q' [w' \in Acc(w) \wedge Q(w')(x')(q')]]$$

$S$  does not yet fulfil the characteristics of a comparison class in the sense that we understand it. It is true that we can associate to an element  $(w, x)$  of  $S$  a (unique) amount  $q$  verifying  $Q(w)(x)(q)$ , but we cannot necessarily distinguish this element from the other members of  $S$  by using this amount property.<sup>7</sup> Suppose that example (1) is true. It is not necessary that the pair  $(w, l)$  – corresponding to Luisa in the evaluation world  $w$  – is distinguished from the other members of  $S$  by its amount. Luisa, or any other individual in a comparable situation, can show the same amount of calm in other accessible worlds without challenging the truth of the sentence. This observation leads us to identify the elements of  $S$  associated with the same amount, in order to obtain the right characterisation of the comparison class. For each pair  $(w', x')$  in  $S$ , there is a unique amount  $q'$  verifying  $Q(w')(x')(q')$ . We say the amount  $q'$  is associated to  $(w', x')$ , and define an equivalence relation  $\sim$  on  $S$  as in (19).

$$(19) \quad (w_1, x_1) \sim (w_2, x_2) \text{ iff } \lambda q' [Q(w_1)(x_1)(q')] = \lambda q' [Q(w_2)(x_2)(q')]$$

The set of equivalence classes defined by the equivalence relation forms a partition of the set  $S$ . This set of cells of the partition constitutes the comparison class of the modal superlative, is called  $C$  and is defined as  $C = S / \sim$ . The perspective initially adopted by constructing the set  $S$  on the individuals and the worlds has slightly changed when the amounts are taken as criterion to classify the individuals, more exactly the pairs. To each cell of  $C$  is associated an amount, namely the amount common to all the individuals of the cell. Such an association allows us to compare Luisa's amount with the amounts associated to the cells of the partition, i.e. from the formal point of view we now arrive at being able to perform the operation done by the superlative.

The association between cells and amounts can be made explicit via a function. Function  $f$  is introduced precisely to allow us to associate to each equivalence class  $c' \in C$ , the unique amount  $q'$  associated to the elements of the class  $c'$ , written  $f(c') = q'$ .

The amounts associated to the cells are distinct among them, because of the way the partition has been constructed, i.e.  $c = c' \leftrightarrow f(c) = f(c')$ . Therefore, there is a bijection between the partition  $C$  and the set  $C'$  of all the  $q'$  that satisfy  $Q(w')(x')(q')$  for some  $x'$  and  $w'$ , defined in (20). Deriving the semantics of the modal superlatives from the superlative operator is easier if one exploits this bijection.<sup>8</sup>

<sup>7</sup>In other terms, we encounter a version of the problem that led some scholars to adopt intensional properties of degrees in their analysis of ordinary superlatives.

<sup>8</sup>Given  $c$  the equivalence class of  $(w, x)$ , the formulae  $f(c) = q$  and  $Q(w)(x)(q)$  are equivalent; and given  $c'$  the

$$(20) \quad C' = \lambda q' [\exists x' \exists w' \in Acc(w) [Q(w')(x')(q')]]$$

In sum, the definition of the comparison class crucially varies according to the superlatives, while the superlative operator – relating to that comparison class – remains unchanged, modulo semantic type adjustments. The fact that the amount  $q'$  becomes the only criterion to distinguish the elements of the comparison class of a modal superlative, is a major difference with the ordinary superlative. In example (1), the uniqueness of Luisa as an individual who manifested a greater amount of calm, is not required. The set of individuals in a comparable situation and in accessible worlds, is not provided by the context and is potentially open.

#### 4.2 The superlative

In the above, a view of the comparison class for modal superlatives as a set of complex entities that are differentiated in terms of amounts has been presented. Each of these complex entities is a collection of individual + world pairs  $(w', x')$  that differ either relatively to  $w'$  or to  $x'$ , but are all associated with the same amount  $q'$  verifying  $Q(w')(x')(q')$ . In other words, the comparison class for modal superlatives is a set of entities, the entities are equivalence classes established on the basis of the information on the amount, thus the members of the comparison class are uniquely identifiable via the amounts. Conversely, the comparison class for ordinary superlatives generally assumed is a set of entities whose members are uniquely identifiable via an identity criterion. In the remainder of the section, it is demonstrated that no consequences necessarily derive from this difference in comparison class for the superlative operator.

The superlative operator is a function that applies to the partition  $C$  and returns True if the amount  $f(c)$  of the class  $c$ , e.g. the class of Luisa in (1), is the largest amount among all the cells of the partition. The superlative is defined as in (21).

$$(21) \quad \lambda C [\exists q [f(c) = q \wedge \forall c' \in C [c' \neq c \rightarrow f(c') < f(c)]]]$$

Leaving the semantic type of at least  $C$ ,  $f$  and  $c$  underspecified in the definition (21), enables it to work for modal and ordinary superlatives. In the general case, the function  $f$  is not necessarily bijective, and it could be the case that another member  $c'$  of  $C$  is associated with the same amount as  $c$ . As [it] is usual in this kind of formula, the restriction  $c' \neq c$  and the strict inequality  $f(c') < f(c)$ , in the definition (21), prevents  $c$  from sharing the same amount as another element of the comparison class. In the specific case of the modal superlative, the function  $f$  establishes a bijection between the set  $C$  of equivalence classes and the set of restricted amounts as in (20). Therefore, the class  $c$  associated with the largest amount is unique and the formula (22) is equivalent to (21), in this case.

$$(22) \quad \lambda C [\exists q [f(c) = q \wedge \forall c' \in C [f(c') \leq f(c)]]]$$

In the case of the modal superlative, the formula in definition (22) entails the uniqueness of the element  $c$  as the largest element of its comparison class  $C$ . In example (1), the element  $c$  is an equivalence class potentially containing several pairs of individuals-worlds, including the

equivalence class of  $(w', x')$  with  $f(c') = q$ , the formulae  $f(c') < f(c)$  and  $q' < q$  are equivalent too. These equivalences are the tools that would allow us to state the superlative operator with  $C'$ , even if it will not be done in the paper.

pair  $(w, l)$  of Luisa in the evaluation world  $w$ . No unicity constraint applies to the individual Luisa, which is consistent with the expected reading.

The formula (21) is the general one, and we briefly discuss how it works for the absolute and relative ordinary superlatives in turn. In the absolute reading, individuals play a discriminating role in the comparison class. The comparison class  $C$  described by the expression *the highest mountain* in (7), can be considered as a set of mountains restricted by the context. The function  $f$  that associates the height of an element (a mountain) of  $C$  is not necessarily bijective, because two mountains in  $C$  can have the same height. Applying the operator (21) to  $C$  gives  $\exists q[f(c)=q \wedge \forall c' \in C[c' \neq c \rightarrow f(c') < f(c)]]$ , which entails the uniqueness of the highest mountain  $c$ . By abstracting the free variable  $c$  and applying the iota operator to it, one arrives at this highest mountain, i.e.  $\iota c[\exists q[f(c)=q \wedge \forall c' \in C[c' \neq c \rightarrow f(c') < f(c)]]$ , the unique mountain whose height is greater than the height of the other mountains.

In the relative reading, the two variables taken into account to constitute the comparison class in (7) are individuals  $x'$  and mountains  $y'$ . Suppose that example (7) is true. The mountaineer who climbs the highest mountain is unique, which shows that the variable  $x'$  must be discriminating in the comparison class. However, in the case where this mountaineer climbs two mountains of the same height higher than the mountains climbed by the other mountaineers, (7) is generally assumed to be false. If it is so, the variable  $y'$  must also be discriminating in the comparison class.<sup>9</sup> The comparison class  $C$  is a set of  $(x, y)$  pairs, namely  $C = \lambda x \lambda y[x \text{ has climbed a } d\text{-high mountain } y]$ , where  $x$  and  $y$  can be restricted by context. The function  $f$  associates the height  $d$  to a pair  $(x, y)$ . Such function  $f$  is clearly not bijective. Applying (21) to  $C$ , we obtain  $\exists q[f(x, y)=q \wedge \forall (x', y') \in C[(x', y') \neq (x, y) \rightarrow f(x', y') < f(x, y)]]$ , where  $x$  is Louise, and  $y$  a mountain Louise climbed. The formula means that  $x$  climbed a mountain higher than the mountains climbed by the other people. The mountain  $y$  climbed by  $x$  is undefined, which we express, as a first approximation, by an existential on  $y$ . By abstraction on the variable  $x$  and application to  $l$  (the constant for Louise), we obtain the formula for the whole sentence  $\exists y \exists q[f(l, y)=q \wedge \forall (x', y') \in C[(x', y') \neq (l, y) \rightarrow f(x', y') < f(l, y)]]$ . This formula correctly accounts for the truth conditions of (7), under the assumption of the uniqueness of the highest mountain. In order to determine the validity of this assumption, it is necessary to take into account psycholinguistic data. The advantage of an analysis that treats both individuals  $x$  and mountains  $y$  as discriminating in the class of comparison is that it makes it easier to take into account this type of empirical data, which is not possible with analyses using degree predicates (intensionalised or not).

### 4.3 Discussion

In this section, we explore in more detail the properties of the proposed analysis by testing it with a series of scenarios. More specifically, we examine how the restriction of the comparison class should be achieved in each case and the consequence on the truth conditions.

We start with a scenario proposed by a reviewer, in which Luisa and Anna are working in the same shop when a difficult customer comes in. Anna is a quiet type, whereas Luisa is not. Luisa has to cope with the difficult customer. In these circumstances, the sentence *Luisa è stata*

<sup>9</sup>In case variable  $y'$  is not discriminating, it is needed a more abstract comparison class made up of the sets of mountains climbed by each individual and associating to each of these sets the height of the highest mountain. Such an analysis reminisces the use of degree predicates (intensionalised or not) that aggregate all the degrees associated with the mountains climbed by the same individual.

*il più calma possibile* (1) is acceptable even though Anna, had she been in Luisa's shoes, would have been much calmer. This scenario is intended to test whether our analysis leads to truth conditions that are too strong. At first glance, it may seem that a world-individual analysis cannot exclude Anna from the individuals to be compared, insofar as Anna seems to be in the same situation as Luisa. Put like this, the scenario requires that certain points be made explicit in order to evaluate the interpretation of the sentence. One point is that if the character traits are relevant and Anna's known patience eliminates her from the possible alternatives, then in the relevant characterisation of the situation via  $Q$  one is also including the constraint that the person is known not to be particularly patient. The paraphrase would be "Luisa was as calm as possible, for someone in her condition and in similar circumstances". This interpretation clearly leaves Anna out of the comparison. Another point is whether it is possible to explicitly restrict the set of alternatives by fixing the extension in the real world, as can be done in the relative superlative reading. This may go beyond the reviewer's scope, but it would theoretically be a way of eliminating Anna from the comparison. It has been observed that it is not possible to provide an explicit comparison class in predicative modal superlatives in Italian (Fleury and Tovenà 2023). Most probably the question is not whether it is possible to set the extension explicitly, but whether it is possible to set it at all, e.g. by considering a particular set of individuals in the real world. Such a restriction would, at best, combine with the restriction based on the relevant type of situation, and at worst compete with it. We were unable to find any convincing example of this type of complex combination.

Another case where Anna is trivially ruled out from the comparison is when only Luisa is taken into consideration, as in the paraphrase "Luisa was at least as calm as she herself could have been in a similar situation". The reviewer seems interested in this case. It has already been pointed out in section 3.2 that the availability of this reading is not uncontroversial, but also that it coincides with the particular type of reading analysed by Loccioni (2019). Let us now see how it can be tackled. When Luisa's calm in the real world is compared with Luisa's calm in possible worlds, the comparison class can be constructed from predicates of the form  $\lambda q[\exists w' \in Acc(w)[calm_w(q)(l)]]$ ,<sup>10</sup> where  $l$  is the constant for Luisa and  $Acc$  an accessibility function that can take care of Luisa's circumstances, whether personal circumstances or circumstances in which Luisa finds herself. It is theoretically possible to adapt our analysis to the reading with a single individual by fixing the variable  $x$  to the constant  $l$  (Luisa). The set  $S$  on which the comparison is built becomes the set of all pairs  $(w', l)$  such that  $\exists q'[w' \in Acc(w) \wedge Q(w')(l)(q')]$ . The equivalence relation remains unchanged except that its domain is restricted to the new set  $S$ . We can write it  $(w_1, l) \sim (w_2, l)$  iff  $\lambda q'[Q(w_1)(l)(q')] = \lambda q'[Q(w_2)(l)(q')]$ . Then the comparison class  $C$  is built as the quotient of the set  $S$  by the equivalence relation  $\sim$ , that is  $S/\sim$ . Such a class can be mapped to the set  $\lambda q'[\exists w' \in Acc(w)[Q(w')(l)(q')]]$ , i.e. the set of all the amounts of calm  $q'$  manifested by Luisa in accessible worlds, in the relevant type of situation expressed by the predicate  $Q$ . The superlative operator is unchanged and applies to the comparison class  $C$ . If this reading exists, the question is to know how the restriction of the situations is distributed, between the modal base and the predicate  $Q$ .

In the reading involving a single individual, we may explore the case where the predicate  $Q$  merely contains the linguistic material from the sentence, and the type of situation is almost entirely expressed within the modal base. Technically, the starting set  $S$  would become the set of pairs  $(w', l)$  satisfying  $\exists q'[w' \in Acc'(w) \wedge calm_w(q')(l)]$ , where the new accessibility function  $Acc'$  would contain all the information relevant to the comparison. The equivalence relation

<sup>10</sup> In Loccioni's notation, it would be  $\lambda d.\diamond[calm(Luisa, d)]$ , where  $d$  is a variable of degree.

on  $S$  would be adapted as follows:  $(w_1, l) \sim (w_2, l)$  iff  $\lambda q' [calm_{w_1}(q')(l)] = \lambda q' [calm_{w_2}(q')(l)]$ . The comparison class  $C$  would be the quotient of  $S$  by  $\sim$  and could be mapped to the set  $\lambda q' [\exists w' \in Acc'(w) [calm_{w'}(q')(l)]]$ . The superlative operator would be unchanged. Note that in all these representations of the modal superlative, the comparison is essentially between degrees of calmness. There is no way of ruling out the possibility of Luisa achieving the maximum degree of calm in several possible worlds, which is the expected reading.

Summing up, in the readings where Luisa is compared to other partly undefined individuals, and not just to herself, the relevant type of situation cannot be entirely translated as a set of propositions true in the real world. The reason is the lack of sufficient information about the individuals whose degree of calm is being compared, some of whom are located in accessible worlds and have no counterpart in the real world. This was discussed in section 3. The relevant type of situation for these readings is coded within the predicate  $Q$ , which is therefore not limited to the linguistic material of the sentence. We emphasise that this way of restricting the type of situation keeps working also for the reading involving a single individual. There is no clear rationale for introducing two mechanisms for selecting the relevant situation type, depending on whether the comparison involves one or several individuals. On the contrary, an analysis for the case where Luisa is compared only with herself that does not make use of a predicate like  $Q$ , does not extend to cover the case where she is compared to other partly undefined individuals.

The previous scenarios allowed us to address the issue of circumstantial selections through the modal basis and the  $Q$  predicate. In the last scenario, the selection of possible worlds is based on deontic considerations, expressed through an ordering source. Imagine that the shop regulations dictate that a purchased article can only be replaced with an article of the same category. The difficult customer wanted to return the purchased article and have their money back. Luisa decided to slightly bend the regulations by allowing for a replacement of the purchased article with one of a different category. A reviewer mentions this scenario in order to test the truth conditions predicted by our analysis. As a matter of fact, with or without an ordering source, the question arises as to the level at which we select the type of situation relevant to the comparison of the modal superlative. In our approach, we would first have the modal base, which selects a set of worlds, then the ordering source establishes an order on the accessible worlds, as usual, and finally the  $Q$  predicate is used to select the type of situation in the best worlds.

### 5. Concluding remarks

This paper has made a semantic case for the modal adjective *possibile* in predicative modal superlatives as a mixed category. The adjective plays the two roles of i) setting up an accessibility relation with a modal base coding a modal colour (circumstantial, deontic, etc.), and ii) projecting a predicate  $Q$  that captures the type of situation involving individuals through the accessible worlds, with some possible homogeneity constraint on the individuals and the worlds. This yields two restrictions of different nature.

The modal base is argued not to suffice to select the alternatives used in the construction of the comparison class; the ordering source does not do it either, for the same reasons. The predicate  $Q$ , which selects the relevant type of situation, is a relation between possible worlds, individuals and amounts, which allows us to select world-individual pairs to be compared. This selection is computed by the set  $S$  defined as  $\lambda x' \lambda w' [\exists q' [w' \in Acc(w) \wedge Q(w')(x')(q')]]$ , i.e. the pairs  $(w', x')$  such that  $x'$  manifests a certain amount  $q'$  in an accessible world  $w'$  and in the situation expressed via  $Q$ . On the one hand, the pairs  $(w', x')$  determine the plurality of the

elements to be compared. They constitute the domain of variability of the modal superlative. In that sense, the modal superlative is anchored to world-individual pairs. Furthermore, the right truth conditions of the modal superlative are obtained by partitioning the world-individual pairs with respect to their associated amount and applying a generic superlative operator to this partition, which is a function that extracts the elements of the partition associated with the biggest amount. On the other hand, the modality expressed by the sentence results not only from the modal base and possibly an ordering source, both determined by the context, but also from the relevant type of situation for the comparison. This analysis gives us some clues for the anchoring of the modality, in the sense of Kratzer (2013). The anchoring of plurality for the superlative and the anchoring of modality are two distinct but very similar things for modal superlatives, because in both cases we are browsing possible worlds.

The right class of comparison for modal superlatives is a set of equivalence classes of pairs of individuals and worlds identified according to their amount, not a set of individuals nor a set of degree predicates. This leads us to assume that the classes of comparison vary as the readings of superlatives vary, at least from the semantic viewpoint. This position is not so new on closer inspection; remember, for example, the difference between entities directly displaying a gradable property in the absolute reading, or showing a derived gradable property in the relative readings. But above all, the variation in classes of comparison is compatible with the superlative operator remaining unchanged, modulo semantic type adjustments.

Indeed, despite their differences, the types of superlatives have the same meaning insofar as they express a selector of a unique  $c$  in a  $C$  on the basis of some measurement property. In the case of the modal superlative, the largest element  $c$  is an equivalence class potentially containing several pairs of individual-worlds. No unicity constraint applies to the individuals, thus no true equative reading relatively to the compared entities on the modal superlative.

Finally, although the adjective *possibile* suggests an existential quantification, the quantification at work in a modal superlative is not a simple quantification but a nested one, where the selection of possible worlds interacts with the selection of individuals. The role of the traditional modality here is essentially to select a modal colour and pre-select a set of possible worlds that are candidates that will be sorted by  $Q$ . But  $Q$  performs its sorting task on worlds and individuals at the same time.

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