When the donkey lost its fleas: Persistence, contextual restriction, and minimal situations*

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1 Introduction

Kratzer (1989) introduces a framework of situation semantics that was taken as a starting point by later work. One of the properties of her theory is that what is true of a small situation must remain true of larger situations that it is a part of. This is known as **persistence**. Her arguments for this condition, however, are conceptual, which led to most work following her to overlook it. This paper returns to this issue, with the following goals in mind:

1. Show that the persistence condition is not just motivated on conceptual grounds, but it is justified empirically.
2. Lay out what is required for propositions to be persistent.
3. Elaborate on the consequences of persistence to different lines of research in situation semantics. Specifically, we shall show that theories of donkey anaphora that require quantification over minimally small situations are in conflict with Kratzer's (2004) theory of contextual restriction, as the latter requires that quantification involve large situations in order to ensure persistence.

1.1 Persistent Propositions

- In the situation semantics framework laid out in Kratzer (1989, 2002), propositions are sets of situations, such that a proposition p is true in a situation s if $s \in p$.

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- Without further restriction, nothing prevents a proposition being true in a situation s, but false in an extension s' of s[1].; take the proposition p which is expressed in (1):

  (1) There are no living kings.

  (1) may be true of a situation s_1 that includes only α and the fact that α lives; but in a situation s_2 that includes α, the fact that he lives, and the fact that he is a king, it is false.

- Kratzer (1989) takes the view that this is an unwelcome result. She suggests that we add a condition that all natural-language propositions be **persistent**[2].

- A **persistent proposition** is a proposition of which it is true that if $s \in p$ and $s \leq s'$, then $s' \in p$.

- If this is correct, then s_1 cannot be a member of the proposition expressed by (1), because of the existence s_2.

- This condition is not enforced by somehow filtering out non-persistent propositions. Rather, Kratzer provides denotations for quantifiers that encode persistence.

2 Minimal situations and donkey anaphora

2.1 The Heim/Elbourne solution for donkey anaphora

- One recent promising usage of situation semantics has been to suggest a solution to the puzzle of donkey anaphora. This was first suggested by Heim (1990), and worked out in detail by Elbourne (2002) and Büring (2004).

- One attractive solution to donkey anaphora is the E-type analysis (Evans (1977, 1980)), wherein the pronoun is taken to have semantics similar to a definite description, such that (2) is interpreted as (3):

  (2) Every farmer who owns a donkey beats it.

  (3) Every farmer who owns a donkey beats [the donkey].

  However, there is a major problem with this solution: definite descriptions require a unique referent, which seems to be missing here as (2) can clearly be true in a context involving multiple donkeys.

[1]We call a situation s' an **extension** of a situation s iff $s \leq s'$ and $s \neq s'$

[2]Terminology due Barwise and Perry (1983). It is important to distinguish this use of *persistent* from the unrelated use of the same term in Barwise and Cooper (1981), where it is used to denote “right upwards monotone”.

- Due to the nature of situation theory, even if there's more than one relevant donkey in the world, there are sub-situations of that world that contain only one donkey. Thus, we can make use of those situations to ensure unique referents for our pronouns.

- All we need to do is make sure we refer to situations small enough to contain exactly one donkey. For this purpose, we can quantify over **minimal situations**. A minimal situation such that p holds is a situation $s \in p$ such that there is no situation $s' \in p$ such that $s' \leq s$.

- For example, the following is Elbourne's denotation for *every*:

  (4) $[\![\text{every}]\!] = \lambda f_{\langle\langle se\rangle,\langle st\rangle\rangle} \lambda g_{\langle\langle se\rangle,\langle st\rangle\rangle} \lambda s_1$. For every individual x: for every minimal situation s_2 such that $s_2 \leq s_1$ and $f(\lambda s.x)(s_2) = 1$, there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $\mathrm{g}(\lambda s.x)(s_3) = 1$

  Paraphrased informally, *every* quantifies not over individuals that have a certain property, but over sub-situations of its argument situation, that contain only the individual and said property. For each of these situations, *every* claims that it is possible to extend it in such a way that a second property holds true of the individual.

- By adding this quantifier denotation to the E-type story, (2) can be informally paraphrased as (5):

  (5) Every situation can be divided up in such a way that for every sub-situation that involves a farmer, a donkey he owns, and nothing else, there is a situation that involves the farmer, the donkey, the ownership, and the fact that the farmer beats the unique donkey in that situation.

2.2 The Problem

2.2.1 The donkey that lost its fleas

- take a world in which there are three farmers (A,B,C), each of which owns a donkey. Farmers A and B each take good care of their respective donkeys, grooming them daily. As a result, their donkeys have no fleas. Farmer C, however, does not groom his donkey, it has many fleas.

- Our intuitions tell us that sentence (6) is true in this context:

  (6) Every farmer who owns a donkey which has no fleas grooms it.

- **But applying the minimal situation analysis as given above to this sentence, (6) is false in this scenario.**

- There is an minimal situation s^{min} which involves farmer C, his donkey, the owning relationship between them, but no fleas, nor possession relations between the fleas and the donkey. Due to the denotation of *every*, every such minimal situation needs to have an expansion wherein the farmer in question (farmer C) grooms the donkey. However, there is no such situation.

2.2.2 The donkeys hiding out of the situation's reach

- A second manifestation of this problem can be seen in the following sentence:

(7) Every man who owns a farm beats every donkey in it.

- **According to the minimal situation analysis as given above, this is a tautology.**

- The restriction of the quantifier requires that we quantify over minimal situations in which a man own a farm. This obviously does not include any donkeys. But every such situation has an extension in which, say, the property that the farmer is a specific height is also included and nothing else. This extension trivially satisfies the condition that the farmer beats every donkey in the farm in the situation, since there are no such donkeys. Thus, the sentence is always true[3].

2.2.3 What went wrong

- There is a clear intuitive notion of what's wrong in these examples.

- In (6), The minimal situation that includes farmer C and his donkey includes no fleas; yet we feel it should not count as a minimal situation *of a farmer who owns a donkey with no fleas*, as the donkey in question does have fleas outside this situation.

- In (7), it does not feel sufficient that for every farmer/farm pair there is an extension in which all the donkeys in that extension are beaten, unless that extension includes all the donkeys in the farm.

- It is here that we need persistence.

- In (6), we need to quantify over minimal situations that involve a donkey with no fleas, **and** are not sub-situations of a situation for which said donkey has fleas.

- In (7), we should require that the man beat every donkey in the farm in the situation in question, and that there is no extension of that situation in which the farmer doesn't beat every donkey in the farm.

[3] This ignores the possibility that *every* has an existence presuppositions. If such a presupposition is reintroduced, then (7) will no longer be a tautology. However, we will still get the wrong truth conditions since the sentence will only require that the farmer beats *some* donkeys.

- Thus, ignoring persistence has empirical consequences for Elbourne (2002).

3 Persistence - consequences and implementation

- First, note that neither (6) nor (7) are a problem because of losing information about the farmers; rather, it is the information from the embedded quantifier phrases *no fleas* and *every donkey in it* that is at stake.

- Thus, persistence isn't just a property of matrix quantifiers, but also of embedded ones.

- All quantifiers which are not upwards monotone on both arguments may cause problems with persistence.

- To see this monotonicity matters, note that our definition of *every* essentially quantifies over all individuals that have property f in s. Assuming that f is a simple property, the set of fs in s is a subset of the set of fs in an extension s' of s.

- Thus, in going from a situation to an extension of it, we are replacing the domain argument of the quantifier by a superset.

- This is always a safe in upwards entailing environments, but not in downwards entailing or non-monotone environments.

- Thus, we need to modify our quantifier denotations to ensure that they remain persistent, even in non-upwards monotone environments.

- Since the problem is in going from a small situation to a larger one, the best way to prevent this problem is to check that the proposition holds in as large a situation as possible.

- This is a potential problem. The Heim/Elbourne solution for donkey anaphora relies on the presupposition that minimal situations give unique referents. But we have just seen that for the sake of persistence we need to look at as large a situation as possible. Can we implement persistence in a way that satisfies both demands?

- We don't have to look far for an implementation that lets us do so. Kratzer (1989) implements persistence[4] by adding a condition that the individuals quantified must satisfy the restriction of a quantifier in the largest situation available (i.e., the entire world) in addition to the situation quantified over. Adding this to Elbourne's *every* gives us the following:

[4] We gloss here over the difference between generic and accidental persistence. See Kratzer (1989) for discussion.

(8) persistent ⟦every⟧ - first attempt= $\lambda f_{\langle\langle se\rangle,\langle st\rangle\rangle}\lambda g_{\langle\langle se\rangle,\langle st\rangle\rangle}\lambda s_1$. For every individual x: if $f(\lambda s.x)(w) = 1$, for every minimal situation s_2 such that $s_2 \leq s_1$ and $f(\lambda s.x)(s_2) = 1$, there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $g(\lambda s.x)(s_3) = 1$

- This denotation allows us to check persistence against the maximal situation w, while at the same time the actual quantification remains on truly minimal situations. Thus, we seem to have the best of both worlds, at least as far as using situations to account for donkey anaphora.
- The question is, what happens when we broaden our view and try to incorporate other uses of situation semantics?

4 Persistence and contextual restriction

- One property of persistent quantification as we've seen it so far is that it is global; every quantifier in some sense quantifies over the whole world.
- On its own, this leads to strange-looking predictions. For example:

  (9) Every tree is laden with wonderful apples.

  By global persistence, (9) would only be true if every tree in the entire world is laden with wonderful apples.
- Kratzer (1989) solves this by appealing to contextual domain restriction to fill in additional descriptive material. We are to take (9) as meaning something along the lines of

  (10) Every tree [in my orchard] is laden with wonderful apples.
- The viability of this option depends heavily on the way in which contextual restriction is implemented.
- While Kratzer (1989) does not provide an actual theory of contextual restriction, she is clear that this must be done by an additional mechanism rather than then the situations themselves, explicitly rejecting the theory of contextual restriction provided in Barwise and Perry (1983) because it relies on non-persistent propositions.

4.1 Contextual restriction via topic situations

- In stark contrast to her earlier position, Kratzer (2004) proposes that contextual restriction should be accounted for not by adding descriptive material to the sentence, but rather by applying the proposition in question to a *topic situation*, which contains only the contextually relevant entities.

- According to Kratzer, utterances in context represent an *Austinian proposition* (after Austin (1950)) - that is, a pairing of a topic situation and a proposition $<s, p>$.

- An assertion operator ASSERT is responsible for applying the topic situation as a situation argument for the proposition (i.e., the one required by the λs of the highest scope operator):

  (11) $[\![\text{ASSERT}]\!](<s, p>) = p(s)$

- Since every embedded operator is passed a situation variable by the next higher operator which is a subsituation of the situation parameter of that operator, this ensures that all quantifiers are restricted to elements of the topic situation.

- Put differently, this system relies on the principle that each operator only has access to the situation that the operator above gives it, and can only pass down parts of that situation to lower operators.

- This principle would be nullified if we use reference to w to ensure persistence, as it allows a quantifier to see information that was not strictly passed down to it by a higher operator.For example, imagine we are discussing the grading of a semantics exam yesterday, wherein exactly one student got a B; surprisingly, she did so without making any errors, but just by failing to answer questions in a satisfactory manner. We can say:

  (12) Some student who made no errors got a B.

  (12) requires the existence of a student who made no mistakes in the relevant context - i.e., on her semantics exam. It will not be false if that student made an error in her phonology exam.

  However, if we check persistence relative to the world, then the error on the phonology exam will be enough to remove the student from the domain of quantification, thus falsifying the sentence.

- Thus, it appears that we need a new definition of persistence, one wherein persistence is local to the situation which the quantifier received as an argument. One suggestion of how to do so is the following:

  (13) locally persistent $[\![\text{every}]\!] = \lambda f_{\langle\langle se\rangle,\langle st\rangle\rangle}\lambda g_{\langle\langle se\rangle,\langle st\rangle\rangle}\lambda s_1$. For every individual x: if $f(\lambda s.x)(s_1) = 1$, for every minimal situation s_2 such that $s_2 \leq s_1$ and $f(\lambda s.x)(s_2) = 1$, there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $\text{g}(\lambda s.x)(s_3) = 1$

- In this formulation, embedded quantifiers no longer have access to everything in the topic situation, but only have access to what is in the situation passed down to them from the higher quantifier, as desired.

- But this reintroduces the problem of potential "leaks". To see this, lets return to (7):

  (7) Every farmer who owns a farm beats every donkey in it.

- As before, the minimal situation in which a farmer x owns a farm contains no donkeys. Now take an arbitrary extension of that situation, lets call it s_{farm}, such that s_{farm} contains no donkeys. By the definition of the quantifier, we now must see whether *beats every donkey in it* is true of x in s_{farm}. This involves passing s_{farm} as the parameter of the quantifier *every*. This is the largest situation which the persistence condition of *every* can see. But there are no donkeys in the farm in s_{farm}. Thus, the persistence condition is toothless in this scenario.

- **Thus, domain restriction that relies on situations variables being passed down from one operator to the next prevents using persistence to solve the problem of elements hiding outside minimal situations.**

- Note that other methods of using situations for domain restriction may not suffer from this problem:

  1. One possible solution is to claim that the topic situation is always available for direct reference in a discourse. Thus, we can use the definition in (13), simply replacing all ws with s_{topic}.
  2. Another possibility, raised by Recanati (2004), is that topic situations are not used to saturate a situation argument slot, but rather are added as a form of semantic enrichment. Such a system would differ enough from Kratzer (2004) that the results above would not necessarily hold for it (though other problems may well arise, based on the exact implementation).

5 Conclusion

We have explored the notion of persistence and shown that the form in which it is implemented has crucial consequences on the applications of situation semantics in linguistics. Not paying proper attention to persistence introduces empirical problems to the system of Elbourne (2002). Attempting to solve these problems taught us more of the nature of persistence and how it interacts with minimal situations. Among the lessons was that implementing a persistent minimal situations approach to donkeys is impossible if the contextual restriction method proposed in Kratzer (2004) is also used.

Thus, the basic lesson of this discussion is that persistence is important. By attending to it, problems may be avoided and hidden problems may be uncovered.

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