

TEMPORAL BINDING IN THE EVENT ANALYSIS

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Abstract: In this paper I investigate a view put forward as an answer to the Binding Argument for meteorological sentences like ‘It is raining’: Cappelen and Hawthorne’s (2007) “Event Analysis”. The view postulates restrictor functions on sets of events as variables harboured by verbs. I take issue with a specific claim of the view, namely that the function maps times to sets of events that take place *at those times*. I provide several examples that challenge that claim. I consider two ways to fix the analysis by making the restrictor function context-sensitive and assess their merits.

Keywords: Event Analysis, Binding Argument, temporal binding, restrictor function, context-sensitivity

Introduction

In this paper I investigate a certain answer to an argument that has prominently featured in the contemporary debate about the semantics of meteorological sentences such as ‘It is raining’ – the Binding Argument. The answer consists in accounting for the bound phenomena that lie at the heart of the Binding Argument by replacing location variables with events variables in the logical form of the target sentences. Such an answer has been provided by Cappelen and Hawthorne (2007). In what follows, I first present the instance of the Binding Argument involving the target sentence ‘It is raining’ that Cappelen and Hawthorne provide an answer to (section 1.) Then we will present Cappelen and Hawthorne’s view, dubbed “the Event Analysis” (section 2) and the way

they handle the relevant binding phenomena. In section 3 I present some problematic cases for their analysis. In section 4 I suggest two ways to implement an obvious modification of the analysis in order to deal with the problematic cases. Section 5 concludes.

1. The Binding Argument

The Binding Argument has been used against views denying that specific target sentences harbour variables for certain parameters in their logical form.¹ The argument starts with the observation that there are bound readings of complex sentences that contain the target sentences in which a certain parameter is bound and concludes, via fairly intuitive syntactic and semantic principles, that the target sentences themselves have a variable for the parameter in question in their logical form. The particular instance of the argument that I will be concerned with in this paper involves locations and meteorological sentences such as ‘It is raining’. This particular instance has played a crucial role in the debate between truth-conditional pragmatics (understood here as a cluster of positions according to which the provision of elements in the content of utterances is done via pragmatic processes that are not required by elements in the logical form of the sentences uttered) and truth-conditional semantics (understood here as a cluster of positions characterized by the claim that “any contextual effect on truth-conditions that is not traceable to an indexical, pronoun, or demonstrative (...) must be traceable to a structural position occupied by a variable” (Stanley 2000, 401)). Thus, Stanley (2000), the chief advocate of truth-conditional semantics, has noted that sentence

- (1) Every time John lights a cigarette, it rains

has a reading according to which every time John lights a cigarette at time t , it rains at time t *in the location in which John lights a cigarette*. The location of rain in (1) is thus bound by the

¹ Logical form will be understood in this paper as whatever syntactic structures are the input to semantics. I want to remain totally neutral with respect to what those structures are.

quantifier 'every time John lights a cigarette'. With this reading of (1) in mind, the instance of the Binding Argument against truth-conditional pragmatics about locations could be put as follows:

1. According to truth-conditional pragmatics, there is no variable for the location of rain in the logical form of the sentence 'It is raining'.
2. In (1), binding occurs: the location of rain varies with the values introduced by the quantifier 'every time John lights a cigarette'.
3. There is no binding without a bindable variable in the logical form.
4. Therefore, there is a variable for the location of rain in the logical form of the sentence 'It is raining'.
5. Therefore, truth-conditional pragmatics is mistaken.²

Before moving to the answer to this instance of the argument we are interested in, let me note that, as it stands, the argument is not valid. The reason it is not is that conclusion 4 doesn't follow from premises 1-3, at least not without additional assumptions. At most, what follows from the first three premises is the intermediary conclusion

(IC) Therefore, there is a variable for the location of rain in the logical form of (1).

In order to get conclusion 4, we need a bridging principle relating the sentence 'It is raining' with (1) in such a way as to make sure that the existence of a variable in the logical form of (1) guarantees the existence of a variable of the same type in the logical form of the target sentence. One attempt at providing such a bridging principle is Recanati's (2002). Discussing the instance of the Binding Argument above, Recanati has noted that it is missing an additional premise and has

² This argument is an adaptation of a similar argument given by Recanati (2002, 328-329) involving the sentence 'Everywhere I go, it rains'.

accused Stanley of committing “the binding fallacy”. He submits that the following supplementary premise is what the proponents of the argument need in order for the argument to go through:

(SUP) In (1), the sentence on which the quantifier ‘every time John lights a cigarette’ operates is the very sentence ‘It is raining’ which can also be uttered in isolation.
(Adapted from Recanati 2002, 329)

Recanati speaks about the same *sentence* here, but what he means is really a representation of the sentence at a deeper level than the linguistic surface. For our purposes here, that deeper level can be taken to be the sentence’s logical form. Reformulating Recanati’s suggestion we get the following bridging principle:

(BP) The logical form of the sentence ‘It is raining’ is the same in (1) as when ‘It is raining’ appears in isolation.

Factoring in (IC) and (BP), the above instance of the Binding Argument could be made valid, the argument taking the following form:

1. According to truth-conditional pragmatics, there is no variable for the location of rain in the logical form of the sentence ‘It is raining’.
 2. In (1), binding occurs: the location of rain varies with the values introduced by the quantifier ‘every time John lights a cigarette’.
 3. There is no binding without a bindable variable in the logical form.
- (IC). Therefore, there is a variable for the location of rain in the logical form of (1).
- (BP). The logical form of ‘It is raining’ is the same in (1) as when ‘It is raining’ appears in isolation.

4. Therefore, there is a variable for the location of rain in the logical form of the sentence 'It is raining'.
5. Therefore, truth-conditional pragmatics is mistaken.³

2. Answering the Binding Argument: the “Event Analysis”

A few answers to the instance of the Binding Argument above have been proposed in the literature. For example, Pagin (2005) has proposed to account for binding phenomena such as those exhibited by (1) by replacing quantification over location variables with quantification over contexts in the metalanguage. In a similar vein, Lasersohn (2008) has proposed replacing quantification over location variables with quantification over indices in the metalanguage. On the truth-conditional pragmatic side, Recanati (2002; 2004) has provided an answer by appealing to what could be called “the variadic function approach”, in essence consisting in the idea that the location of rain is provided in (1) by optional pragmatic processes and not by a location variable present in the logical form of ‘rain’. Finally, closer to the spirit of the truth-conditional semantic view, one way to respond to the argument could be extracted from Elbourne’s (2005) work on pronominal anaphora: quantification over situations in the object language rather than

³ Another important issue concerning the Binding Argument is this. One major criticism of the argument has been that it overgenerates variables in the logical form of various sentences that would usually be treated without positing variables. This is a serious and legitimate concern, and I tend to agree with this criticism. However, one way in which the argument could be interpreted is not as a decisive argument for the presence of a variable in the logical form of the target sentences, but as the basis for *an inference to the best explanation* of binding phenomena (this is the third interpretation of the argument mentioned in Stanley (2005)). In other words, whenever we find binding phenomena, there is a *prima facie* case to be made that there is a variable in the logical form of the target sentences. Interpreted this way, the Binding Argument could still be used in specific cases without claiming that all instances of binding need to be explained by postulating variables in the logical form of the target sentences – alternative and equally good explanations of the binding phenomena notwithstanding. This is consistent with saying that, even if postulations of variables across the board to account for binding phenomena is not a good idea, there might be cases in which the postulation of variables is, *prima facie*, the best explanation to be given. The case of location, as far as I can see, is such a case in point: *prima facie*, the binding phenomena involving the location of rain is to be explained by postulating location variables in simple sentences containing the predicate ‘rain’. The debate will then be whether in the specific case of ‘rain’, postulation of a location variable in simple sentences such as ‘It is raining’ is the best way to explain binding phenomena such as those exhibited by (1), or whether there is an alternative, equally good explanation of the phenomena. Cappelen and Hawthorne’s analysis is precisely such an alternative.

over locations. A similar view is that of Cappelen and Hawthorne (2007), who propose to account for binding by replacing quantification over location variables with quantification over events. This is the answer we will be concerned with in what follows.^{4,5}

So, Cappelen and Hawthorne's claim is that the binding phenomena exhibited by sentences such as (1) are better explained by "the Event Analysis".⁶ The Event Analysis consists of the *mélange* of two main ideas: first, the idea that verbs are predicates of events; second, the idea that domain restrictions are associated with certain phrases. The first idea stems from Davidson's (1967) view that has led to the development of "event semantics". To illustrate, for Davidson the sentence

(2) Brutus killed Caesar.

is represented as

(3) There is an event *e* that is a killing of Caesar by Brutus.

The second idea, that domain restrictions are associated with certain phrases, comes from work by von Stechow (1994) and Stanley & Szabo (2000), among others. They argue that quantifier phrases have a variable for domains in their logical form that are responsible for the restricted readings of sentences and could be bound. To exemplify, the sentence

(4) Every student passed the exam.

⁴ For a thorough discussion of all these answers to the Binding Argument, see Zeman (2011) and, more recently, Zeman (2017).

⁵ A more radical approach would be to eschew variables altogether, as in Jacobson's (1999) framework.

⁶ At least better than Stanley's (2000) truth-conditional semantic view, which is their main target.

is represented as

- (5) (Every student)_{*d*} passed the exam.⁷

where *d* is the domain variable. Particular values for *d* give rise to restricted readings for (4) – for example, the reading that every student *in the relevant class* passed the exam.

Cappelen and Hawthorne’s novel idea is that domain restrictions are attached to verbs and thus, that the sets of events that verbs stand for could be restricted in certain ways. Binding by higher quantifiers is taken care of by suitably restricting the sets of events verbs stand for by means of a restrictor function *f*. Now, the particular claim that they make in the case of binding involving temporal quantifiers is that *f* is a function from times to sets of events that take place at the those times plus other conditions pertaining to the type of the parameter bound. For the case of bound locations, as in (1), this additional condition is that the sets of events that constitute the output of function *f* take place not only at the same times quantified over by the quantifier phrase, but also *at the same location*. Let us see how this works by means of some examples. The simple sentence

- (6) Nina is walking her dog.

is represented in their framework as

⁷ There is an internal debate amongst proponents of the view that quantifier phrases host a domain variable in their logical form regarding the exact location of the variable (the noun phrase, as Stanley & Szabo (2000) think, or the quantifier, as von Stechow (1994) does). This issue has no relevance in what follows.

- (7) There is an event e that is a walking of a dog by Nina.

A more complex sentence such as

- (8) Every time Sam goes to the park, Nina is walking her dog.

is represented in the Event Analysis as

- (9) For all times t , if there is an event e_1 that is a going to the park by Sam at t , there is an event e_2 that is a walking $_{f(t)}$ of a dog by Nina.

In (9), t is the time of event e_1 (quantified over), while $f(t)$ is a function from times t to the set of events that take place at t in the park where Sam goes. Walking $_{f(t)}$ is thus the set of events arrived at by intersecting the set of events that take place at t in the park where Sam goes with the set of events of walking – that is, the set of events of walking that take place at t in the park where Sam goes.

Returning to our problematic case, sentence (1) is represented as

- (10) For every time t , if there is an event e_1 that is a lighting of a cigarette by John at t , then there is an event e_2 that is a raining $_{f(t)}$.

In (10), t is the time of the event e_1 (quantified over), while $f(t)$ is a function from times t to the set of events that take place at t in the location where John lights a cigarette. Raining $_{f(t)}$ is thus the set of events arrived at by intersecting the set of events that take place at t in the location where

John lights a cigarette with the sent of events of raining – that is, the set of events of raining that take place at t in the location where John lights a cigarette.

How does this treatment help with blocking the instance of the binding argument presented above? The place to look is premise 3, the principle that there is no binding without a bindable variable in the logical form. In fact, this premise is ambiguous between a reading according to which there is no binding without a bindable variable in the logical form simpliciter, and a reading according to which there is no binding without a bindable variable of the same kind as the bound parameter in the logical form. On the first of this readings premise 3 holds under the Event Analysis; on the second reading, the premise is denied, because according to the view there is no *location* variable in the logical form of (1), but the location of rain is nevertheless bound. Thus means that the intermediary conclusion (IC) cannot be derived, and thus that the argument is blocked.

3. Problematic Cases for the Event Analysis

I might be persuaded that the answer to the Binding Argument given by the Event Analysis works, but for that the view's account of temporal quantification needs to be correct. However, I have doubts that this is indeed so. Suspicions that the view, as stated, doesn't yield the right predictions come from cases in which there is binding, but the time of the second event and the time quantified over by the quantifier are not identical. More precisely: there are cases in which the restrictor function f cannot be a function from times to sets of events that take place at those times (I'm leaving aside the constraint that the two events should also occur at the same place.) In this section I provide several cases that make this point.

To ease our way into such cases, consider two examples of sentences that contain temporal expressions that effectively influence the time at which the events quantified over by the temporal quantifier take place. Thus, in sentence

- (11) Every time John does a bad deed, somebody suffers later,

the suffering caused by John's bad deed takes place at a later time than the time of the deed itself. The temporal order could also be reversed: in sentence

(12) Every time John does a bad deed, somebody has hurt him earlier,

the hurting that John has been subjected to takes place before John's bad deed itself. While these examples illustrate the claim made, they are nevertheless not problematic (at least not in principle) for the Event Analysis, given that the semantic effect of the relevant expressions ('later' and 'earlier') will have to be factored into the analysis.⁸

However, the same effect can be achieved with sentences that *don't* contain temporal expressions that effectively influence the time at which the events quantified over by the temporal quantifier take place. The first type of case is the following. Consider sentences (13) and (14):

(13) Every time there is a major solar eruption, Earth's artificial satellites break down.

(14) Every time John gets caught by rain, he drinks a cup of hot tea.

Each of those sentences have a reading according to which the second event takes place at a time that is later than the time of the first event, quantified over by the quantifier phrase. In (13), the breaking down of earth's satellites cannot take place at the same time as the solar eruption, since the effect of the eruption will be manifested on the satellites after a certain period of time. (14) is understood as John drinking a cup of hot tea not at the same time he gets caught by rain, but

⁸ Cappelen and Hawthorne don't actually discuss such sentences, but I credit them with an account of the relevant temporal expressions.

(supposedly) when he gets to a warm place where tea is available. But in both cases the Event Analysis yields a different result. To illustrate, consider its rendering of (13):

- (15) For all times t , if there is an event e_1 that is a major solar eruption at t , then there is an event e_2 that is a breaking down $_{f(t)}$ of Earth's artificial satellites.

In (15), t is the time of the event e_1 (quantified over), while $f(t)$ is a function from times t to the set of events that take place at t . Breaking down $_{f(t)}$ is thus the set of events arrived at by intersecting the set of events that take place at t with the set of events of breaking down – that is, the set of events of breaking down that take place at t . However, as we have seen, this is not the case for the reading of (13) envisaged, so the analysis yields wrong results.

One way for the proponents of the Event Analysis to reply to these cases is to claim that there are special, their special character stemming from the fact that there is a causal/explanatory connection between the two events, e_1 and e_2 . The fact that Earth's satellites break down is caused and (at least partially) explained by the solar eruption. John's drinking of a hot cup of tea is caused and (at least partially) explained by him getting caught by rain. Given that normally an event that causes another takes place earlier than the caused event, and taking into consideration the regularities that come together with causation (the fact that Earth's satellites break down at a very precise interval of time after the solar eruption takes place; the fact that usually people drink tea to avoid the negative effects of being caught by rain), we shouldn't expect that the caused event takes place at the same time as the causing event. But such cases are not among the ones that the analysis is supposed to apply and thus they don't endanger it.

Such an answer would not only drastically limit the analysis' range of application, but it is also unsatisfactory in itself. For the point made by examples such as (13) and (14) could be made by other examples in which no causal/explanatory connection holds between the two events. Consider, for example, sentence (16):

(16) Every time John passes by a black cat, a member of his family gets ill.

Here, no causal/explanatory connection holds between the two events, yet the sentence has a reading according to which the second event takes place later than the first. Again, the analysis yields the wrong result.

A more comprehensive answer from the proponents of the Event Analysis, applicable to (13), (14) and (16) as well, could be the following. It is true that there are readings of various sentences according to which the second event takes place later than the first, but those readings are not licensed by the semantics; instead, they are arrived at by pragmatic processes such as implicatures. Thus, strictly speaking, the truth-conditions of sentences such as (13) and (16) are such that the two events take place at the same time; what the speaker communicates, however, is a different content, to the effect that the second event takes place later than the first. It is thus not incumbent on the Event Analysis – which is a theory dealing with the semantics proper of such sentences – to account for those readings.

This answer would save the Event Analysis provided that for each reading according to which the second event is later than the first there is a reading according to which the two events take place at the same time. But this cannot be the case in general. Consider, for example, the following scenario. John, a ruthless serial killer, has been arrested many times, but never convicted because of lack of decisive evidence. He has been released after each arrest. Sadly, after each release he strikes again: sometimes in the following days, sometimes after months, once even after three years. Sentence (17) could be accurately used in this situation:

(17) Every time John is released, he kills.

(17)'s representation in the Event Analysis is

- (18) For all times t , if there is an event e_1 that is a release of John at t , then there is an event e_2 that is a killing $_{f(t)}$ by John.

In (18), t is the time of the event e_1 (quantified over), while $f(t)$ is a function from times t to the set of events that take place at t . Killing $_{f(t)}$ is thus the set of events arrived at by intersecting the set of events that take place at t with the set of events of killing – that is, the set of events of killing that take place at t . Now, this is not the right result in scenario imagined; but also, the answer proposed above cannot work since (17) doesn't have a reading according to which the two events take place at the same time, because it is not possible for John to be both released and to kill at the same time. Also, there is no causal/explanatory connection between the two events, so the first answer doesn't work either. Thus, the Event Analysis does yield the wrong results, even after considering the two replies above.⁹

I would like to note in passing that there are cases of binding in which the second event takes place *before* the first event, the one quantified over by the quantifier phrase. Consider (19) or (20):

- (19) Every time John organizes a family dinner, he cooks.
(20) Every time John takes a shower, he puts on his swimming suit.

Even without going into details, it is easy to see that the Event Analysis yields the wrong results in these cases too.

⁹ I don't want to claim that only sentence (17) poses the problem mentioned for the Event Analysis. For example, all the other problematic sentences presented above have both interpretations in which a specific, determinate period of time between the two sets of events is intended and interpretation in which an unspecific, indeterminate period of time is intended. I use sentence (17), *as uttered in the context devised*, to be an important counterexample because the interpretation in which there is a specific, determinate period of time between the two sets of events is ruled out by design. To make things more understandable, I take the intended interpretations for all the other examples to be, in contrast to (17), that there is a specific, determinate period of time between the two sets of events.

4. Possible Fixes

I think the examples above raise a legitimate challenge to the Event Analysis as presented by Cappelen and Hawthorne. But there is also a quite natural fix, underlined by the idea that the restriction on the set of events, function f , is contextually determined. In the remainder of this last section, I mention a couple of ways to implement this idea and briefly discuss their merits.

The idea that the restriction function on the set of events is context-sensitive can be implemented in at least two ways. First, the proponents of the Event Analysis could hold that f itself is context-sensitive; that is, to claim it as a function from times to sets of events suitably restricted by context. Under this proposal, f can take different values and thus be a function from times to sets of events that take place at some time after those times (thus accounting for examples like (13), (14) and (16)), a function from times to sets of events that take place before those times (thus accounting for examples like (19) and (20)), or – the initial analysis – a function from times to sets of events that take place precisely at those times (thus accounting for the main example used in the debate, (1)).

This solution seems obvious, and in line with other proposals in the vicinity (e.g., Stanley's (2000)). But while it accounts neatly for the examples mentioned above, it still has problems with (17). Remember, the background story for that sentence was that there is no constant period of time after which the killer strikes again once released. So, there is no contextually-determined function that would be the value of f in this context. The most the defender of the Event Analysis can do in this case is to offer the following gloss: f is the function from times to sets of events that take place *at some time after* those times. To my ears, this sounds too indeterminate, and thus the truth conditions too weak, but it could be argued that it does give the right result in the scenario imagined for (17).

The second way to implement the idea under discussion is to claim not that f itself is context-sensitive, but that a different element in the logical form of the relevant sentences is. Thus, while f is understood simply as a function from times to sets of events, the relation between

them is further restricted by introducing an additional element in the logical form of the relevant sentences. Under this second proposal, (1) for example will be represented as

- (22) For every time t , if there is an event e_1 that is a lighting of a cigarette by John at t , then there is an event e_2 that is a raining $_{f(t)}$ and $R(t, e_2)$,

where R is the relation that holds between t and e_2 such that e_2 takes place at t . Different examples will employ different R relations; thus, for examples like (13), (14) and (16), the relation between t and e_2 is such that e_2 takes place after t , while for examples like (19) and (20) the relation is such that e_2 takes place before t .

Again, this implementation accounts for the examples mentioned, but remains problematic as applied to (17). The reason is the same as before: in the case of (17), there is no determinate relation between t and e_2 that could be the value of R in this context. And, as before, the most the defender of the Event Analysis can do in this case is to offer the following gloss: R is the relation between t and e_2 such that e_2 takes place *at some time after* t . To my ears, this sounds too indeterminate, and thus the truth conditions too weak, but it could be argued that it does give the right result in the scenario imagined for (17).

The current analysis has also another backdrop – namely, that it postulates an additional element in the logical form of the relevant sentences. Where there was a single additional variable (the restrictor function f), now there are two (f and R .) Perhaps this worry can be assuaged by noting that Cappelen and Hawthorne are, in fact, non-committal when it comes to variables in the logical form. Thus, they write:

Some may prefer to think of this as a perspicuous depiction of a structured proposition, but deny that there is any isomorphic syntactic representation at [logical form] (...). Others will go further and endorse [it] as a promising account of the deep logical form, manifest in the language organ. (...) It is obviously beyond the scope of this essay to adjudicate

between these versions of an event-based approach. In particular, then, we make no claim here as to which syntactic proposals should accompany the semantic suggestions that we have made. (Cappelen and Hawthorne 2007, 103-4)

There is nothing wrong with such a non-committal attitude in itself, but in the present context it really takes the edge from Cappelen and Hawthorne's opposition to a more committed view like Stanley, which they take to be their main competitor. Things get additionally muddled given that such an attitude is consistent with a construal of the processes by which the elements that appear in the truth-conditions of the target sentences as pragmatic in Recanati's sense.¹⁰ I won't dwell further on these issues; suffice it to say that the initial analysis proposed by Cappelen and Hawthorne needs to be modified, and that neither of the two implementations of the fix considered is obviously problem-free.

5. Conclusions

In this short paper I investigated a specific view about location binding in examples like (1) – the Event Analysis. After introducing the context in which the analysis has been proposed (that of the Binding Argument, one of the most prominent arguments in the debate over the syntactic and semantic characteristics of meteorological sentences like 'It is raining'), I presented the view in detail and how it deals with the target sentences. A crucial element of the view is the introduction in the logical form of such sentences of a restrictor function on events, f , that replaces binding

¹⁰ It is perhaps interesting to note that Recanati himself has hinted at a truth-conditional pragmatic treatment of 'rain'-sentences involving events rather than locations: "[W]e may think of the pragmatic enrichment at issue in terms of a contextual restriction on the domain of the event quantifier, rather than in terms of an extra conjunct in the scope of that quantifier. (...) [This] analysis straightforwardly applies to the 'rain' case: 'It's raining' literally says that there is a raining event, but may be contextually understood as saying that there is such an event among the events that take place at a certain location. The reference to a place in weather sentences is now construed as a byproduct of the contextual restriction of the event quantifier." (Recanati 2007, 134). Strictly speaking, his view differs from Cappelen and Hawthorne in that the restriction is performed on the domain of the quantifier, and not on the set of events, but a case could be made that result is the same.

over location variables. A central tenet of the view is that the restrictor function f is one from times to sets of events that take place at those times. My main aim in this paper was to challenge that claim by providing examples in which the sets of events in question take place either *after* the times taken as input by the function (examples (13), (14) and (16)) or *before* (examples (19) or (20)). Such examples pointed – decisively, in my opinion – to the need to modify the analysis.

Further, I considered two ways in which an obvious fix to the Event Analysis can be implemented. The fix consisted in making the restrictor function introduced *context-sensitive*. I have shown two ways in which this can be done: one, by making the function f itself context-sensitive; the other by leaving the function context-invariant and introducing an additional element in the logical form that is context sensitive (a relation R between events and times). In the final part of the paper I have assessed the merits of these two ways of fixing the Event Analysis. The evaluation was mostly positive, in that both manage to neatly account for the examples considered – with one exception, sentence (17). This is an example that was set in a special context that blocks the moves afforded by the two implementations. The conclusion of the paper is that ultimately the viability of the Event Analysis depends on whether its treatment of sentences like (17) is ultimately considered satisfactory.

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