賽局理論語意學與指涉之不可測度說

Francisco Calvo Garzón

摘要

此篇論文有兩部分,第一,我將討論分別由 Hookway 及 Calvo Garzon 所提出對 Quine 的指涉之不可測度說的兩個辯護。第二，我將討論 Hintikka 的賽局理論語意學如何延伸 Quine 徹底翻譯之行為判准。我將論證，Hintikka 語意學所提出的行為判准將可限制不當的語意理論。尤其是，我將說明儘管 Hintikka 的行為與料不符 Hookway 的方案，它仍說明了為什麼我所謂的不當語意理

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論享有一般語意理論所享有的特權地位。

關鍵詞：

指涉之不可測度說、徹底翻譯、賽局理論語意學

Game-Theoretical Semantics and Referential Inscrutability

Francisco Calvo Garzón*

Abstract

This paper consists of two parts. First, (i) I shall consider two defences of Quine´s polemical Thesis of the Inscrutability of Reference put forward by Hookway (1988), and Calvo Garzón (2000a; 2000b), respectively. Then, (ii) I shall consider an extension of Quine´s succinct behavioural criteria of Radical Translation suggested by Hintikka´s Game-Theoretical Semantics (1973; 1976). I shall argue that Hintikka´s semantics suggest behavioural criteria which we can use to constrain perverse semantic theories. In particular, I shall try to show that whilst Hintikka´s behavioural data tells against Hookway´s proposal, it reveals, nonetheless, a reason as to why my proposed perverse semantic theory enjoys the same priviledged status that a standard semantic theory is supposed to enjoy.

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Referential inscrutability; Radical translation; Game-Theoretical Semantics

Game-Theoretical Semantics and Referential Inscrutability*

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I. Introduction: The Juggling Strategy

In his well-known parable of *Radical Translation*, Quine brings into play an ideal situation in which there is no connection whatsoever between the speakers of two different languages. One is the Native language; the other, the linguist's under which the inquiry will take place. The task is to reconstruct the Native language by means of a translation manual. This manual, when finally completed, should be able to correlate each of the potentially infinite number of sentences uttered by the natives with one or more sentences belonging to the linguist's Home language. The linguist is not allowed to correlate Native expressions with those of the Home language on the grounds that they pin down the same *idea*. Quine's naturalism forbids us to visit the *Museum of Ideas*. Unable to pair words with language-independent mental acts, the linguist starts from scratch, acknowledging as a genuine evidential basis only the stimulation of her sensory receptors. Upon this she will try theories in search of true prediction.

The linguist starts from an articulated web of Native sentences with no assumptions as to how they are going to be analytically dissected into their constitutive terms. Quine considers an utterance of the native one-word observation sentence 'Gavagai'. [1] By

[1] Due to the enormous amount of literature in the last four decades on Quine's project of Radical Translation, I shall try to go very briefly in this opening section over the details of the parable. The reader familiar with Quine´s parable may wish to skip this section, and jump ahead to section II. The reader interested in the fine-grained detail is urged to visit the *locus classici*: Quine (1960), chapter 2; and (1969), chapter 1. See also Calvo Garzón (1999)

observing that on all the occasions in which the native had assented to/dissented from ‘Gavagai?’, the linguist would have given the same response to ‘There is a rabbit?’, the linguist inductively arrives to the conclusion that ‘Gavagai’ is stimulus synonymous with the English sentence ‘There is a rabbit’. In this way, the linguist will be tempted to conclude that, for instance, the native term ‘gavagai’ can be equated with our Home term ‘rabbit’. However, according to Quine, we need not assume that the native term ‘gavagai’ refers to the set of rabbits on the basis that the Native and English related sentential counterparts are stimulus synonymous. The reason is simply that we could still retain the identity of stimulus meaning of ‘Gavagai’, and ‘There is a rabbit’, while arguing that ‘gavagai’ as a term divides its reference over things other than rabbits. Well-known putative examples are undetached parts of rabbits, their temporal stages, or any other perverse referent that ‘gavagai’ might divide its reference over which does not violate Quine’s behavioural adequacy conditions.

Thus, all the available evidence being the linguistic and non-linguistic dispositions of the native speakers under observable circumstances, it cannot be confirmed that ‘gavagai’ refers to the set of rabbits as opposed to any of the aforementioned perverse alternatives. In short, we could be in possession of more than one correct manual of translation. All of which would agree which Native

for a comprehensive review. For a very good critical analysis of Quine’s Inscrutability Thesis, and links to other well-known theses of Quine, the reader may care to consult Kirk (1986). See also Wright (1997).

and Home sentences should be ascribed identical stimulus meaning. However such manuals are mutually incompatible since the terms of Home correlated with a given word of Native by each manual pick out different sets of objects in the world. In this way, we may have a standard manual that equates the native term ‘gavagai’ with ‘rabbit’, whereas a perverse manual might equate the same native term with, let’s say, ‘undetached rabbit part’. In conclusion, there is no objective fact of the matter as to which manual is the correct one, and what the extension of the Native term ‘gavagai’ is.

Someone might think that the ‘gavagai’ example, as it stands, is not significant. The reason for this has to do with the example that has been chosen to exemplify the thesis. One-word observation sentences, such as ‘gavagai’, are an extreme case. The whole sentence takes the form of a single noun; it is not accompanied by any other grammatical devices such as singular or plural endings, definite or indefinite articles, counting expressions, etc. Someone might, thus, object that the plurality of choice will disappear as soon as we pay attention to more complex constructions in which ‘Gavagai’ is no longer a one-word sentence, but has rather been inserted into a bigger one.

The kind of sentential constructions we should pay attention to are the ones involving, for example, *Identity* as in ‘... the same as ...’, *Quantity* as in ‘there are x ...’, *Plurality*, etc.[2] The anti-Quinean

[2] For the reader not familiar, these are the sort of constructions Quine refers to as the *apparatus of reference*—see Quine (1973), esp. Part III. In this paper I shall refer to this

argues that by paying attention to the apparatus of individuation, perverse alternatives à la Quine will be behaviourally discredited. Hence, by asking the native, let's say, whether *there are two or three* so-and-so present, we may be able to tell whether the so-and-so is a term of divided reference or a mass term, for instance.[3] If the native is able to answer the question, that could count as evidence in support of the thesis that the so-and-so divides its reference. On the other hand, abstention of judgment may count as evidence in support of the thesis that 'gavagai' refers to objects not subject to such division.

Imagine then, for the sake of the argument, that we could ask the native whether certain gavagai is or is not the same as the one she saw the day before, or about the number of gavagai present at a the time of the query. In this way (borrowing, and recasting an example from Christopher Hookway, 1988, pp. 148-9), if the linguist asked the native: 'Cuántos gavagai hay allí?', she may translate the native's answer (let us say, 'Dos gavagai') as 'There are two rabbits', and she would feel confident enough about her translation manual because of what she observes about the native's environment and her linguistic behaviour. However , as Quine points out, it may have been rash of the linguist to reject the other putative alternative translations of 'gavagai':

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sort of constructions as the *apparatus of individuation*.

3 Notice that this strategy already involves a crucial assumption that I shall grant for argument's sake. Namely, that the linguists are able to ask questions in Native where the apparatus of individuation is present.

We could equate a native expression with any of the disparate English terms ‘rabbit’, ‘rabbit stage’, ‘undetached rabbit part’, etc., and still, by compensatorily juggling the translation of numerical identity and associated particles, preserve conformity to stimulus meanings of occasion sentences. (Quine, 1960, p. 54)

Let us illustrate how this juggling would work: When the linguist translates standardly ‘Dos gavagai’ as ‘There are two rabbits’, she is pressumably employing the following principle of translation, **ST**:

(a) ‘dos’ => ‘there are two’ and

(b) ‘gavagai’ => ‘rabbits’.[4]

The Quinean, however, does not need to do a very difficult adjustment in order to translate perversely ‘gavagai’ as ‘undetached rabbit part’. By changing (a) for

(a)* ‘dos’ => ‘there are two animals which are composed of’,

then she will be able to replace (b) by

(b)* ‘gavagai’ => ‘undetached rabbit parts’.

And now, by putting (a)* and (b)* together, the perverse linguist

[4] The reader should notice that ‘=>’ here is not a logical device. We are only deploying translation rules in a loose sense. I use ‘=>’ simply to reflect the fact that the terms appearing at both sides of the equation enjoy a similar role in their respective languages, such that stimulus synonymy at the sentential level is preserved. A more rigourous framework will be required when we move from manuals of translation to theories of semantics (see Calvo Garzón, 2000a).

can make use of an alternative translation manual (hereafter, **PT**) that renders the native utterance 'Dos gavagai' as 'There are two animals which are composed of undetached rabbit parts'.[5] Hence, by means of compensatory adjustments, Quine claims, the perverse manual is as compatible with the behavioural facts as the standard manual is assumed to be.

In like vein, we can compensatorily adjust all the rest of the Native expressions, and argue, for example, that the translation of the Native sentence 'Cuántos gavagai hay allí?', is not our standard 'How many rabbits are there over there?', but rather the perverse 'Of how many animals are there undetached rabbit parts over there?' (cf. Wright, 1997). Nonetheless, it is worth remarking that Quine acknowledges that we should employ the standard manual, instead of the perverse alternatives. The very point that the Quinean would like to stress is that that choice is based completely upon *pragmatic* interests: No particular manual is *actually true*, against the others.

Enough of preliminaries. In the next two sections I shall consider one problem with Quine´s juggling strategy that has been highlighted by Hookway.

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5 As the careful reader will have noticed, the perverse manual is obliged to specify that the undetached rabbit parts belong to two different animals. Otherwise, if we said, for instance, 'There are two undetached rabbit parts', we might be referring to two different parts of the same animal (see below).

II. DEALING WITH THE APPARATUS OF INDIVIDUATION

The reader familiar with the 'gavagai' literature will surely recall one problem with the above Quinean proposal that has been highlighted by Hookway. As Hookway (1988, pp. 149-51) notes, thanks to the juggling strategy, the perverse manual seems to cope satisfactorily with *gavagai-related* sentences. But what would happen if we were confronted with a sentence of Native, let's say, 'Dos rosas', that the standard manual, **ST**, translates correctly as 'There are two roses'? How could the perverse manual preserve stimulus synonymy? If the perverse linguist claims that 'rosas' must be translated as 'undetached rose parts', then she is obliged to do some adjustments elsewhere. Unfortunately, according to her perverse manual, **PT**, 'dos' has been translated as in (a)* above. So, the perverse linguist would come out with something like 'There are two animals which are composed of undetached rose parts' as the translation of the Native utterance 'Dos rosas'. For obvious reasons, a perverse manual that deploys that translation would not be faithful to the evidence. It seems then that Quine's juggling strategy fails when we start dealing with things other than rabbits.[6]

[6] There is no point in arguing that, unlike English speakers, natives might lack the apparatus to construct this sort of expressions. Even if the Inscrutability of Reference were true with respect to speakers of Native, its real significance would be missed unless we transfer the parable of Radical Translation to *home*. If the line of argument to be developed below is correct, the very point is that there is no singular individuation machinery to be assumed or not at home. When two fellow speakers match their utterances phoneme by phoneme by the homophonic rule, their situation is not different from the one in Quine's parable. Their

However, on behalf of Quine, Hookway offers a solution to the problem. The perverse linguist could produce a somewhat more cumbersome translation manual, call it **HT**, by changing (a)* above for the following *disjunctive* rule of translation:

(a) ** 'dos' => 'two animals which are composed of', when dealing with rabbit-related utterances,

or

'dos' => 'two plants which are composed of', when dealing with rose-related ones.

So, with the help of a disjunctive rule of translation the perverse manual **HT** can cope both with rabbits and roses. However, it is not difficult to guess the next move of the anti-Quinean. How would the perverse manual translate a new Native sentence that the standard manual has matched correctly with, for instance, our 'There are two stones'? The solution would be to insert another disjunct in (a)** in order to account for mineral-related utterances. And, now the anti-Quinean can do the same move once again, and so on and so forth.[7] The result is that the perverse linguist would come out with a

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decision not to employ a heterophonic manual is due exclusively to reasons of simplicity. But in terms of fidelity of speech to evidence, heterophonic and homophonic transcriptions are on a par. Although I shall concentrate for purposes of exposition on the "dos rosas" kind of example, the reader should bear in mind that the problem is more general. As a matter of fact, it would even apply to the same speaker at different times for every single Home term!

[7] The reader familiar with the literature will have noticed that (a)** is actually different from Hookway's original version. His is hybrid in the sense that he employs a perverse disjunct for counting rabbits and a standard one when dealing with any other sort of objects. I find it more realistic to go for a fully-perverse manual all the way down. However, whatever choice we make (fully perverse, or standard-cum-perverse à la Hookway) will not influence my overall purposes (cf. Calvo Garzón, 2000a).

translation manual which conforms to the evidence but which is extremely cumbersome.[8]

Consider now, on behalf of Quine, the following solution to the problem. The perverse linguist could produce a different manual of translation (hereafter, **PT**$^{+}$) by changing the standard principle of translation, (b),

(b) 'gavagai' => 'rabbits'

to the following non-standard rule of translation:

(b) *** 'gavagai' => '99% undetached rabbit parts'.

We may talk in terms of the percentage of the whole rabbit, including the percentage of its surface, that we assign as the extension of 'gavagai'. In this way, the perverse rule of translation (b)*** reflects the fact that 'gavagai' divides its reference over an undetached 99% part of the whole rabbit, including 99% of its surface. Assuming that the standard theory of translation, **ST**, is behaviourally fully adequate, the perverse theory of translation **PT**$^{+}$ is behaviourally fully adequate too. A translator guided by (b)*** will predict Native assent to/dissent from the query "gavagai?" in exactly the same sort of circumstances in which one guided by the standard theory of translation would.[9]

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[8] Whether such *ad hoc* manual can still be taken to be as correct as the standard one is something that I shall not consider for present purposes (see Calvo Garzón, 2003).

[9] The reader may wonder why a perverse linguist would employ (b)***. (b)*** relates to a sketched theory of translation which I have developed elsewhere (Calvo Garzón, 2000a;

PT^{+} differs from Hookway´s proposed manual of translation, **HT**. Thanks to the '99%-urp' scheme of translation, we do *not* need to make use of disjunctive rules of translation to deal with complex structures where the apparatus of individuation is present. Consider Quine's original rendering of 'gavagai' as contemplated under the perverse rule of translation (b)*:

(b)* 'gavagai' => 'undetached rabbit parts'.

If we try to avoid Hookway's rendering of 'dos' (as related in each particular disjunct to animals or plants or minerals, etc.) and talk, instead, of satisfaction conditions over *things in general* by means of one non-disjunctive axiom, we are in trouble. The reason is that according to **PT** we will obtain the following truth theorem for the native utterance 'Dos gavagai':[10]

(t) 'dos'^'gavagai' is true iff (∃x)(∃y) (x is an undetached rabbit part & y is an undetached rabbit part & x≠y & (z) (z is an undetached rabbit part → (z=x or z=y)))

2000b) in order to bypass a counter-example that Gareth Evans (1975) offered against Quine´s Inscrutability Thesis. However, for our purposes, we need only bear in mind that (b)*** is empirically adequate whenever the standard principle of translation (b) is empirically adequate.

[10] Although Quine initially employed his parable to illustrate the Indeterminacy of Translation, Referential Inscrutability actually concerns indeterminacy in the Semantic field. By transferring Quine's original formulation into Semantics, we fear no loss: Any theory of Semantics will have to match Native with Home sentences. And in doing so the semanticist relies upon the same body of evidence as the translator does. Namely, native assent to/dissent from queries under concurrent observable circumstances. In what follows, I shall recast the linguists´rules of translation in terms of truth theorems in order to pave the way for *Game-Theoretical Semantics* (see below).

Theorem (t) tells us that there are two, and no more than two, things which are undetached rabbit parts. But according to (t), native speakers would not assent to 'Dos gavagai?' even when faced with exactly two rabbits. For obviously, even a single rabbit has many more than two undetached parts.

However, we may substitute (b)*** for (b)*—i.e., the perverse rule of translation for 'gavagai' contemplated under **PT**$^{+}$:

(b)*** 'gavagai' => '99% undetached rabbit parts'.

By taking 'gavagai' as dividing its reference over 99%-urp, we obtain the following theorem:

(t_1) 'dos'^'gavagai' is true iff (∃x)(∃y) (x is a 99%-urp & y is a 99%-urp & x≠y & (z) (z is a 99%-urp → (z=x or z=y)))

This is better, but still won't do. Theorem (t_1) tells us that there are two, and no more than two, things which are 99%-urps. But, according to (t_1), 'Dos gavagai?' would still not be assented to in presence of a pair of rabbits: For each individual rabbit consists of indefinitely many 99%-urps, obtained by selecting a different 1% of the rabbit as the remainder.[11]

One final adjustment will permit us to generate the truth theorem required. In order to preserve stimulus synonymy with

[11] Notice that 'x≠y' in (t_1) just means that x is *different* from y. The disanalogy, however, could be simply a matter of not having one particle in common; x and y could, thus, be sharing the rest of their components.

respect to the standard theory, we simply need the two 99% undetached rabbit parts not to overlap. Take the symbol '÷' to represent the fact that two objects are different in the sense that they share no particle at all. By changing 'y÷z' for 'y≠z', we shall obtain the following theorem:

(t_2) 'dos'^'gavagai' is true iff (∃x)(∃y) (x is a 99%-urp & y is a 99%-urp & x÷y & (z) (z is a 99%-urp → (¬z÷x or ¬z÷y)))

Now, according to (t_2), it requires exactly two rabbits to make 'dos gavagai' true, for we could not possibly be referring to two different 99% parts of one single rabbit which did not overlap.[12] Notice that thanks to **PT**$^+$, we avoid deploying context-sensitive translations of 'dos' à la Hookway. The native term 'dos' can be translated as 'there are two non-overlapping ...'. Hence, we can couple the expression in question, 'dos', with the 99% undetached part of any object at all, irrespectively of its nature, avoiding, thus, having to discern among plants, animals, etc. In this way, according to **PT**$^+$, we can translate the native sentence 'Dos rosas' as 'There are exactly two non-overlapping 99% undetached rose parts'.

The reader might worry that **PT**$^+$ cannot assign 'Dos gavagai' a correct truth condition if and only if there are exactly two rabbits. For,

[12] Notice that it would have been useless to employ '÷' in (t) since y and z could share no particle at all, and still be two different things belonging to the same rabbit. We avoid this difficulty when the two things are as big as the 99% of a rabbit.

the reader might think, a single rabbit has indefinitely many (partially overlapping) 99%-urps. Hence the first rabbit provides an indefinitely large stock of 99%-urps none of which overlap with any of the indefinitely large number of 99%-urps provided by the second rabbit. However, **PT**$^{+}$ does get the truth conditions of 'Dos gavagai' right. Any choice of value for x and of a value for y rendering the sentence true selects a pair of non-overlapping 99%-urps, which perforce have to come one from each rabbit, and then there is no third non-overlapping 99%-urp. Thus 'Dos gavagai' comes out true if and only if there are two rabbits.

By digging in the apparatus of individuation (plurals, identity, etc.) the anti-Quinean hoped to discover some data recalcitrant to perverse interpretations of Native sentences. However, Hookway, on the one hand, managed to overcome potential difficulties by translating 'dos' in a context-dependent way. On the other hand, I offered a different solution to the problem; a solution that avoids the deployment of context-dependent principles of translation. In conclusion, the plurality of choice does *not* disappear when we pay attention to sentential constructions involving the apparatus of individuation. The reader should bear in mind, nonetheless, that Hookway's strategy, **HT**, could be successfully applied, but at the cost of loosing structural simplicity when compared to **ST**. In the remainder of the paper I shall argue that, confronted with **PT**$^{+}$, **ST**, and **HT**, there is actually a behavioural body of evidence favouring **PT**$^{+}$ and **ST**.

III. Game-Theoretical Semantics

In this section I shall consider an extension of Quine´s succinct behavioural criteria of Radical Translation suggested by Jaakko Hintikka´s Game-Theoretical Semantics (1973; 1976). I shall argue that Hintikka´s semantics suggest behavioural criteria which we can use to constrain perverse semantic theories. In particular, I shall try to show that whilst Hintikka´s behavioural data tells against Hookway´s disjunctive proposal, it reveals, nonetheless, a reason as to why my perverse proposal, **PT**$^{+}$, enjoys the same priviledged status that the standard theory, **ST**, is supposed to enjoy. So, without further ado, let´s flesh out these considerations.

We gain an argument for the indiscernibility of **PT**$^{+}$ and **ST**, and for the superiority of **PT**$^{+}$ over Hookway's proposal, **HT**, if we consider game-theoretical semantics as an epistemic model. **ST**, **PT**$^{+}$ and **HT** respectively provide the following translations of 'Dos gavagai':—[13]

(**ST**) $(\exists x)(\exists y)$ (x is a rabbit & y is a rabbit & $\neg x=y$ & (z) ($\neg$z is a rabbit $\vee$ (z=x $\vee$ z=y)))

(**PT**$^{+}$) $(\exists x)(\exists y)$ (x is a 99%-urp & y is a 99%-urp & $x \div y$ & (z) ($\neg$z is a 99%-urp $\vee$ ($\neg z \div x \vee \neg z \div y$)))

(**HT**) $(\exists x)(\exists y)$ {Animal x & Animal y & $x \neq y$ & (ω) ($\neg\omega$ is a

[13] I have replaced expressions of the form 'p $\rightarrow$ q' by '$\neg$p $\vee$ q', since, as we shall shortly see, Hintikka does not give game-rules for '$\rightarrow$'.

component of $x \vee \omega$ is an undetached rabbit part) & (ω) ($\neg\omega$ is a component of $y \vee \omega$ is an undetached rabbit part) & (z) [$\neg$(Animal z & (ω) ($\neg\omega$ is a component of $z \vee \omega$ is an undetached rabbit part)) $\vee$ (z=x $\vee$ z=y)]}

We usually think of a native assenting to 'Dos gavagai' in the obvious presence of a pair of rabbits, and hence the only relevant behaviour of the native might be immediate assent. But epistemic circumstances might be more difficult—the native might be set the task of finding out whether there are exactly two rabbits living in the large overgrown orchard, which might involve crawling around finding rabbits and distinguishing them from the other inhabitants of the orchard. We might then expect more complex behaviour leading up to an assent to 'Dos gavagai?', behaviour which displays a canonical verification procedure following the logical form of (**ST**), or (**PT**$^{+}$), or (**HT**). Hintikka's game-theoretical semantics gives us a model for canonical verification of 'Dos gavagai' under our three proposed translations. In this way we might look for behavioural evidence in favour of one or other translation.

In *Logic, Language-games and Information*, Hintikka offers game-theoretical semantics which we can apply to (**ST**), (**PT**$^{+}$), and (**HT**)[14]—see Hintikka, 1973, pp. 86-8. Simplified, the game of

[14] The reader may care to consult Hintikka (1976) for an employment of game-theoretical semantics in a context wider than radical translation as a way to grasp the connection between quantifiers of Formal Logic and quantifiers in Natural Languages. See also Tennant (1987).

‘searching and finding’ goes as follows:

The game is played on a given quantified sentence, S. The game is played by two persons—the truth proponent of S (hereafer the proponent) who is committed to showing that S is true, and her opponent, the falsity proponent of S (hereafter the opponent), who is committed to showing that S is not true. Proponent and opponent are invited to play out semantic games on S, according to the rules set out below. At each round of a game the play focuses on the main constant and results in a simpler sentence, which is then the subject of play in the next round of the game, until an atomic formula is reached when the game stops. If the atomic formula is true, whoever is proponent at that stage of the game has won, and if it is false whoever is opponent at that stage of the game has won. For S to be true is for the proponent of S to have a winning strategy. That is, a repertoire of plays such that she wins whatever her opponent may play. The interesting idea from our point of view is that a winning strategy will reflect the logical form of S, since plays of the game will trace the nested structure of logical constants in S. Hence, we will expect, the behaviour of one who is seeking to discover whether she has a winning strategy on S will, in general, reflect the nested logical structure of S, since the players have to discover whether or not they have winning strategies on various simpler sentences generated in the play on S when the logical constants are succesively stripped away. Thus we may hope to predict behavioural differences in between one who is a proponent of (**ST**) as against one who is a

proponent of (**PT**$^{+}$), as against one who is a proponent of (**HT**). At least we may hope to do so when the determination of 'Dos gavagai' is particularly difficult and forced to follow an ideal canonical epistemic route mapped out by its logical form.[15], [16]

To play the game we need to learn some basic rules. At each stage of the game, at which a quantifier is the main constant, a player chooses a member of the universe of discourse. Similarily, at each stage at which a propositional operator is the main constant, a player chooses a disjunct or a conjunct, depending on the form of the sentence being considered. But we need to know *who* is the one to choose. This will depend on the kind of sentence in question. Hintikka gives the following five rules:

R1 If S is (∃x) F(x), the proponent chooses a member of D—i.e., the universe of discourse—, and gives it a proper name, say 'b'. The game is then continued with respect to F(b).

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[15] The relevancy of Hintikka's strategy for our purposes is that the games are played in strict behavioural terms, without appeal to normative or rational considerations. Although Hintikka's concern is not the translation of terms and ontologies, but rather the translation of quantifiers—see Hintikka (1973), pp. 87-ff.—I believe, nonetheless, that we can employ his insights to throw some light upon our current semantic and ontological worries.

[16] By 'ideal' I mean the following: In any particular game, the number of rounds necessary to arrive at an atomic sentence and verify it depends on the *ability* of both contestants. The fact that a given sentence is true doesn't imply that it *will* be verified by the proponent, but only that it *can* be verified. Whether the proponent manages to verify it or not depends on how smart she is in her choice of individuals. In the same way, if her opponent is dumber, it will be easier for the proponent to win; but if the opponent plays a good game, the proponent will have to perform at her best to win the game. Hence, what I mean by an 'ideal game' is that game where the two contenders play at the possibly *maximum* level to achieve their purposes.

R_2 If S is (x) F(x), the same happens except that the opponent chooses b.

R_3 If S is (F $\vee$ G), the proponent chooses F or G, and the game is continued with respect to it.

R_4 If S is (F $\wedge$ G), the same happens except that the opponent makes the choice.

R_5 If S is ¬F, the roles of the two players (as defined by rules R_1, R_2, R_3 and R_4) are reversed and the game is continued with respect to F. (Adapted from Hintikka, 1976, p. 217)

By following these rules, the proponent and her opponent will keep on choosing individuals, disjuncts and conjuncts alternatively (depending on the form of the sentence S) until they obtain an atomic sentence which contains no quantifier phrase at all. If that atomic sentence is true then whoever has the role of proponent at that stage wins, and otherwise whoever has the role of opponent at that stage wins. Now we can see why Hintikka calls it a game of 'seeking and finding'. Each player seeks for the individuals that will verify or falsify any quantified statement in dispute, or seeks which disjunct or conjunct to select. The underlying thought in Hintikka's strategy is then that, for decidable statements, if S is true, then the proponent of S will have a winning strategy to verify it.

Let's now see the bearing of Game-Theoretical Semantics for

our present purposes. As a preliminary and to fix ideas, I illustrate by describing a game on (**ST**), with obvious abbreviations.

(s) $(\exists x)(\exists y)\ ((Rx \ \&\ Ry) \ \&\ x \neq y \ \&\ (z)\ (\neg Rz \vee (z=x \vee z=y)))$

Round 1:[17] Sp chooses r_1,

Play continues on:—

$(\exists y)\ ((Rr_1 \ \&\ Ry) \ \&\ r_1 \neq y \ \&\ (z)\ (\neg Rz \vee (z=r_1 \vee z=y)))$

Round 2: Sp chooses r_2,

Play continues on:—

$(Rr_1 \ \&\ Rr_2) \ \&\ r_1 \neq r_2 \ \&\ (z)\ (\neg Rz \vee (z=r_1 \vee z=r_2))$

Round 3: So chooses 3rd. conjunct,

Play continues on:—

$(z)\ (\neg Rz \vee (z=r_1 \vee z=r_2))$

Round 4: So chooses o,

Play continues on:—

$\neg Ro \vee (o=r_1 \vee o=r_2)$

Round 5: Sp chooses 1st. disjunct,

Play continues on:—

$\neg Ro$

Round 6: So is committed to the truth and Sp to the falsity of:—

Ro

[17] 'Sp' stands for the proponent of (s), and 'So' for her opponent. For economy I take the set of individuals on which the predicates are interpreted to contain only three objects: two rabbits and an unspecified object other than a rabbit—abbreviated respectively r_1, r_2, and o.

Game Over

Sp wins if ‘Ro’ is false, otherwise So has won this particular game.

If (**ST**) gives the logical form of ‘Dos gavagai’ then one who asserts ‘Dos gavagai’ claims, in effect, to have a winning strategy on (**ST**). So we may expect the behaviour leading up to an assertion of ‘Dos gavagai’ to be, in an ideal case, the behaviour of one seeking to discover whether they have a winning strategy on (**ST**). And similarily, of course, for (**PT**$^{+}$) and (**HT**). We may now note a striking parallel between (**ST**) and (**PT**$^{+}$).

For every game on (**ST**) leading to an atomic sentence in the left hand column, there is an exactly parallel game on (**PT**$^{+}$) leading to the ‘atomic’ sentences in the right hand column:—

A is a rabbit	A* is a 99%-urp
B is a rabbit	B* is a 99%-urp
A=B	A÷B
C is a rabbit	C* is a 99%-urp
C=A	¬C*÷A
C=B	¬C*÷B

where A=A*, unless A is a rabbit in which case A* is a 99% undetached part of that rabbit, and B and B*, and C and C*, similarly.

Now, if the game on (**ST**) produces a win for the proponent, so

does the corresponding game on (**PT**$^{+}$), and *vice versa*. So it seems that the behaviour of a proponent trying to see whether they have a winning strategy on (**ST**) will be indistinguishable from the behaviour of a proponent trying to see whether they have a winning strategy on (**PT**$^{+}$).

However, it might seem that nonehteless there are two differences, which I will consider in turn:—

(1) In the last two cases, games on (**PT**$^{+}$) have a further round in which roles are swapped and a final round is played on 'C*÷A' or on 'C*÷B'. Perhaps we can hope to test this difference of length in their respective games behaviouristically. But this is not a difference which registers in behaviour. The proponent is the asserter of 'Dos gavagai', but the opponent is only a notional character. All that happens is that when a proponent reaches 'C=A' she has to determine whether C and A are identical. Likewise, all that happens when a proponent reaches '¬C*÷A' is that they have to determine whether C* and A partially overlap. No behaviour will reveal which of these tasks a proponent is engaged in. Similarly for 'C=B' and '¬C*÷B'.

(2) 'A is a rabbit' is an atomic sentence, and it is assumed that when a game is played in which this is the terminus, and proponent and opponent know who has won, this is because 'A is a rabbit' is verified or falsified by direct observation. But 'A* is a 99%-urp' is not, in absolute terms, an atomic sentence. It has significant semantically relevant structure. Thus, it is to be distinguished from, for example, 'A* is a 5%-urp'. So it might seem that we should

analyse ‘A is a 99%-urp’ along the lines of

(∃x)(∃y)(∃n) (x is a rabbit & y=A* & n=99 & y is n% of x),

and then the game should continue on this. However, this is to misunderstand the nature of Quine’s proposed indeterminacy of radical translation, and the proposal (**PT**$^{+}$) in particular. Although ‘A* is an undetached rabbit part’ is indeed semantically complex, Quine assumes that it is *epistemically* equivalent to ‘A is a rabbit’. On all occasions in which one is able to verify or falsify ‘A is a rabbit’ by direct observation, one can also verify or falsify ‘A* is an undetached rabbit part’ by direct observation, and *vice versa*, Quine assumes. The same holds for ‘A is a rabbit’ and ‘A* is a 99%-urp’, we are assuming. So from the point of view of epistemic behaviour, we can regard games which reach ‘A* is a 99%-urp’ as terminating there, as we do regard games which reach ‘A is a rabbit’, the winner being decided by direct observation.

Thus, in sum, any behaviour which is interpretable as seeking and finding in the service of discovering a winning strategy on (**ST**) is equally interpretable as seeking and finding in the service of discovering a winning strategy on (**PT**$^{+}$), and *vice versa*.

Unfortunately for Hookway’s route, the same cannot be said for (**ST**) and (**HT**). Recall the logical form of ‘Dos gavagai’ offered by Hookway’s translation manual:

(**HT**) (∃x)(∃y) {Animal x & Animal y & x≠y & (ω) (¬ω is a component of x ∨ ω is an undetached rabbit part) & (ω)

(¬ω is a component of y ∨ ω is an undetached rabbit part) & (z) [¬(Animal z & (ω) (¬ω is a component of z ∨ ω is an undetached rabbit part)) ∨ (z=x ∨ z=y)]}

As we saw above, games on (**ST**) lead to one or other of:—

A is a rabbit
B is a rabbit
A=B
C is a rabbit
C=A
C=B

On the other hand, games on (**HT**) lead to one or other of:—

A is an animal
B is an animal
A=B
C is a component of A
C is an undetached rabbit part
D is a component of B
D is an undetached rabbit part
E is an animal
F is a component of E
F is an undetached rabbit part
F=A
F=B

A sympathizer of Hookway who asserts ‘Dos gavagai’ would claim, in effect, to have a winning strategy on (**HT**)—assuming that (**HT**) gives the logical form of ‘Dos gavagai’. As in the cases of (**ST**) and (**PT**$^{+}$) above, we may expect the behaviour leading up to an assertion of ‘Dos gavagai’ to be, in an ideal case, the behaviour of one seeking to discover whether they have a winning strategy on (**HT**). However, the reader can see that unlike games on (**PT**$^{+}$), games on (**HT**) lead to one or other of the above sentences by routes which are *not* images of those on (**ST**). This disanalogy permits us to predict behavioural differences in between one who is a proponent of (**ST**), as against one who is a proponent of (**HT**). We shall be able to distinguish the behaviour of a proponent trying to see whether they have a winning strategy on (**ST**) from the behaviour of a proponent trying to see whether they have a winning strategy on (**HT**). Therefore, any behaviour which is interpretable as seeking and finding in the service of discovering a winning strategy on (**ST**)—or for that matter, on (**PT**$^{+}$)—*cannot* be interpreted as seeking and finding in the service of discovering a winning strategy on Hookway’s route, (**HT**).

Although we have only considered one example, ‘Dos gavagai’, the points made generalize. There is an obvious isomorphism between the translation manuals (**ST**) and (**PT**$^{+}$) with ‘is a rabbit’ in (**ST**) as the image of ‘is a 99%-urp’ in (**PT**$^{+}$). Likewise, there is an obvious lack of isomorphism between the translation manuals (**ST**) and (**PT**$^{+}$), on the one hand, and (**HT**), on the other. Provided we can

take ‘is a rabbit’ as observationally equivalent to ‘is a 99%-urp’—see above—, then the native’s behaviour when seeking to verify a native sentence S will be equally interpretable as seeking to verify that she has a winning strategy on sentence S delivered by (**ST**), and as seeking to verify that she has a winning strategy on the corresponding sentence delivered by (**PT**$^{+}$), and *vice versa*.

In sum, by looking at the native’s complex patterns of behaviour leading up to an assent to ‘Dos gavagai?’, I contended, we’ve gained an argument for the indiscernibility of the semantic theories **PT**$^{+}$ and **ST**, and for the superiority of **PT**$^{+}$ over Hookway’s proposal. Plausibly, the points made concerning ‘Dos gavagai’ generalize to all sentences of Native—see Calvo Garzón (2000b; 2000c).

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