

# *Strawsonian vs. Russellian Definite Descriptions*

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**Abstract:** In 1905 Bertrand Russell took on the problem of definite descriptions, and his analysis became the standard up until 1950 when Peter Strawson criticised Russell's solution as inadequate. Since then many opponents as well as proponents of the Russellian solution have been involved in a long-term debate on definite descriptions. In this paper I show that both sides of the contention are partly right and partly wrong, because sentences of the form "The *F* is a *G*" are ambiguous. However, the ambiguity does not concern reference shift of the description 'the *F*'. Rather, the ambiguity consists in different *topic-focus* articulations of a given sentence involving occurrences of 'the *F*'. I demonstrate that when 'the *F*' is used as part of the topic of such a sentence the existence of the object denoted by 'the *F*' is not only entailed by but also presupposed by the sentence. On the other hand, 'the *F*' used in the focus of a sentence triggers merely existential entailment. Thus sentences differing only in their topic-focus articulation should have assigned different logical forms. In order to make such hidden features explicit, I apply the procedural semantics of Transparent Intensional Logic (TIL), furnishing sentences with hyperpropositions that are precisely defined in terms of TIL *constructions*. These are *procedures* assigned to sentences as their context-invariant structured meanings. Moreover, I generalise the phenomenon of the topic-focus distinction to sentences of any form, proposing an adequate analytic schema of sentences that come with a presupposition.

**Keywords:** definite description, topic-focus articulation, *de dicto* vs. *de re* supposition, structured meaning, procedural semantics, hyperproposition, TIL.

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## 1 Introduction

There is a substantial difference between proper names and definite descriptions. This distinction is of crucial importance due to their vastly different logical behaviour. Independently of any particular theory of proper names, it should be granted that a *proper* proper name (as opposed to a definite description grammatically masquerading as a proper name) is a rigid designator of a numerically particular individual. On the other hand, a definite *description* like, for instance, ‘the Mayor of Dunedin’, ‘the King of France’, etc., offers an *empirical criterion* that enables us to establish which individual, if any, satisfies the criterion at a particular state of affairs.

The contemporary discussion of the distinction between names and descriptions was triggered by Russell (1905).<sup>1</sup> Russell’s key idea is the proposal that a sentence like

(1) The  $F$  is a  $G$

containing a definite description ‘the  $F$ ’, is understood to have the logical form of (1’)

(1’)  $\exists x (Fx \wedge \forall y (Fy \supset x=y) \wedge Gx)$

rather than  $G(\iota x Fx)$ . Thus Russell actually proposed the elimination of the descriptive operator ‘ $\iota$ ’ understood as ‘the only’, and deprived definite descriptions of their self-contained meaning. Though Russell’s theory seems to be currently the dominant theory of definite descriptions, it has encountered its fair share of criticism.

Apart from the fact that Russell’s translation of simple sentences like “The  $F$  is a  $G$ ” into the molecular form “There is an  $F$  and at most one thing is an  $F$  and this thing is a  $G$ ” is rather enigmatic, the criticism concerns the contention that Russell simply got the truth conditions wrong in important cases of using descriptions when there is no such thing as the unique  $F$ .

This criticism was triggered by Strawson who in (1950) objected that Russell’s theory predicts the wrong truth-conditions for sentences like ‘The present King of France is bald’. According to Russell’s analysis, this sentence is false, but according to Strawson, this does not conform to our

<sup>1</sup> I am grateful to Pavel Materna for remarks and comments to this introductory section.

intuitions about its truth or falsity. In Strawson's view, the sentence in a world at a time where there is no King of France can be neither true nor false. It is not true, obviously. However, if it were false then its negation "The King of France is not bald" would be true, which entails that there is a unique King of France, contrary to the assumption. Strawson vacillated between two alternatives. Either the sentence has a truth-value gap, or it fails to express a determinate proposition. If there is no present King of France, then an utterance containing such an expression is somehow defective. Strawson held that sentences like these do not *entail* the existence of the present King of France, but rather *presuppose* his existence. If 'the present King of France' fails to refer, then the presupposition is false and the sentence fails to have a determinate truth value.<sup>2</sup>

Russell (1957) in response to Strawson's criticism argued that, despite Strawson's protests, the sentence was in fact false:

Suppose, for example, that in some country there was a law that no person could hold public office if he considered it false that the Ruler of the Universe is wise. I think an avowed atheist who took advantage of Mr. Strawson's doctrine to say that he did not hold this proposition false would be regarded as a somewhat shifty character. (Ludlow, 2007)

Strawson himself in (1964) came to doubt whether the debate of entailment versus presupposition could be settled by "brisk little formal argument[s]".

Donnellan (1966) observed that there is a sense in which Strawson and Russell are both right (and both wrong) about the proper analysis of definite descriptions, because definite descriptions can be used in (at least) two different ways. On a so-called *attributive use*, a sentence of the form 'The *F* is a *G*' is used to express a proposition equivalent to 'Whatever is uniquely *F* is *G*'. Alternatively, on a *referential use*, a sentence of the form 'The *F* is a *G*' is used to pick out a specific individual, *a*, and say of *a* that *a* is a *G*. Donnellan suggested that Russell's quantificational account of definite descriptions might capture attributive uses, but that it does not work for referential uses. Ludlow in (2007) interprets Donnellan as arguing that in some cases descriptions are Russellian and in other cases they are Strawsonian. And he adds that "perhaps we could even say that the definite determiner 'the' is ambiguous between these two

<sup>2</sup> Nevertheless, for Strawson, *sentences* are meaningful in and of themselves, independently of the empirical facts like contingent non-existence of the King of France.

cases (it is not clear whether Donnellan himself intended to endorse a lexical ambiguity of this sort)".

Kripke (1977) responded to Donnellan by arguing that the Russellian account of definite descriptions could, by itself, account for both referential and attributive uses, and that the difference between the two cases could be entirely a matter of pragmatics, because there is an important distinction between what one literally says by an utterance and what one intends to communicate by that utterance.

However, Neale (1990) supported Russell's view by collecting a number of previously observed cases in which intuitions about truth conditions clearly do not support Strawson's view. On the other hand, a number of linguists have recently come to Strawson's defense on this matter. For a detailed survey of the arguments supporting Strawson's view as well as Russell's view, see Ludlow (2007). Here it might suffice to say that Strawson's concerns have not delivered a knock-out blow to Russell's theory of descriptions, and so this topic remains very much active.

In this paper I am not going to take into account Kripke's pragmatic factors like the intentions of a speaker. In other words, I am not going to take into account what a speaker might have meant by his/her utterance, for this is irrelevant to a *logical* semantic theory. Instead, I will propose a *literal semantic analysis* of sentences of the form "The *F* is a *G*". What I want to show is this. First, definite descriptions are not deprived of a self-contained meaning and they denote one and the same entity in any context. Thus they are never Russellian. Second, Russell was nevertheless right in his insight that a definite description 'the *F*' does not refer to a definite individual. Rather, it denotes a condition to be contingently satisfied by the individual (if any) that happens to be the *F*. I will explicate such conditions in terms of possible-world intensions, *viz.* as individual roles or offices to be occupied by exactly one individual per world/time pair. Third, I am going to show that Donnellan was right that sentences of the form "The *F* is a *G*" are ambiguous. However, their ambiguity does not concern a shift of meaning of the definite description 'the *F*'. Rather, the ambiguity concerns different *topic-focus* articulations of these sentences. There are two options. Description 'the *F*' may occur in the topic of a sentence and some *G* (the focus) is predicated about the topic. This case corresponds to Donnellan's *referential* use; using medieval terminology I will say that 'the *F*' occurs with *de re* supposition. The other option is '*G*' occurring in the topic and 'the *F*' in the focus of the sentence. This reading

corresponds to Donnellan's *attributive* use of 'the *F*' and the description occurs with *de dicto* supposition. Consequently, such sentences are ambiguous between their *de dicto* and *de re* readings. On their *de re* reading they *presuppose* the existence of a unique *F*. Thus Strawson's analysis appears to be adequate for *de re* cases. On their *de dicto* reading they have the truth-conditions as specified by Russellian analysis. They do not presuppose, but only entail, the existence of a unique *F*. However, the Russellian analysis, though being equivalent to the one I am going to propose, is not an adequate literal analysis of *de dicto* readings, because it deprives the semantically meaningful constituent 'the *F*' of its meaning.

There has been much dispute among theoretical linguists and logicians over whether the problem of topic-focus articulation is a problem of semantics rather than pragmatics. In this paper I am going to demonstrate the *semantic* nature of the topic-focus difference by means of a *logical* analysis. To this end I apply the procedural semantics of *Transparent Intensional Logic* (TIL) and assign (algorithmically structured) procedures to expressions as their meanings. As a result, I will furnish sentences differing only in the topic-focus articulation with different structured meanings producing different possible-world propositions.

I am also going to show that the proposed solution of the definite description problem generalizes to any sentences differing in their topic-focus articulation. While the clause standing in the topic generates the case of a presupposition, a focus-clause usually entails rather than presupposes another proposition. Thus I am going to introduce a general analytic schema of sentences that come with a presupposition. Since our logic is a hyperintensional logic of *partial functions*, I analyse sentences with presuppositions in a natural way. It means that I furnish them with hyperpropositions, *viz.* procedures that produce possible-world propositions with truth-value gaps. Having a rigorous, fine-grained analysis at our disposal, we can then easily infer relevant consequences.<sup>3</sup>

The paper is organised as follows.<sup>4</sup> After briefly introducing the philosophy of TIL and its basic notions in Section 2, the main Section 3 in-

<sup>3</sup> For an introduction to the notion of hyperproposition, see Jespersen, B. 'How hyper are hyperpropositions?', *Language and Linguistics Compass*, forthcoming.

<sup>4</sup> Some results of this paper are taken from the paper presented by the author at CICLING 2009, *Computational Linguistics and Intelligent Text Processing* conference in Mexico City, see Duží (2009).

roduces the method of analysing sentences with presuppositions induced by the topic of a sentence, and entailment triggered by a focus clause. The method is then applied to a *de re* and a *de dicto* reading, respectively, of the analysed sentences of the form “The *F* is a *G*”. Finally, I generalise the method to sentences of any form. Section 4 concludes by indicating the direction of future research and a few notes on implementation of TIL *via* the *TIL-Script* functional programming language.

## 2 A Brief Introduction to TIL

TIL is an overarching semantic theory for all sorts of discourse, whether colloquial, scientific, mathematical or logical.<sup>5</sup> The semantic theory is a procedural one, according to which sense is an abstract, pre-linguistic procedure detailing what operations to apply to what procedural constituents to arrive at the product (if any) of the procedure. Such procedures are rigorously defined as TIL *constructions*. The semantics is tailored to the hardest case, as constituted by hyperintensional contexts, and generalized from there to simpler intensional and extensional contexts. This entirely anti-contextual and compositional semantics is, to the best of my knowledge, the only one that deals with all kinds of context in a uniform way. Thus the sense of a sentence is an algorithmically structured *construction* of the proposition denoted by the sentence. The denoted proposition is a flat, or unstructured, mapping with domain in a logical space of possible worlds. Our motive for working ‘top-down’ has to do with anti-contextualism: any given unambiguous term or expression (even one involving indexicals or anaphoric pronouns) expresses the same construction as its sense whatever sort of context the term or expression is embedded within. And the meaning of an expression determines the respective denoted entity (if any), but not vice versa. The denoted entities are (possibly 0-ary) functions understood as set-theoretical mappings. Thus we strictly distinguish between a procedure (construction) and its product (here, a constructed function), and between a function and its value.

Intuitively, construction *C* is a *procedure* (a generalised algorithm). Constructions are *structured* in the following way. Each construction *C*

<sup>5</sup> For details, see, for instance, Duží – Jespersen – Materna (forthcoming), Materna (2004), Tichý (1988) and Tichý (2004).

consists of sub-instructions (constituents), each of which needs to be executed when executing  $C$ . Thus a specification of a construction is a specification of an instruction on how to proceed in order to obtain the output entity given some input entities.<sup>6</sup>

There are two kinds of constructions, atomic and compound (molecular). Atomic constructions (*Variables* and *Trivializations*) do not contain any other constituent but themselves; they specify objects (of any type) on which compound constructions operate. The *variables*  $x, y, p, q, \dots$ , construct objects dependently on a valuation; they  $v$ -construct. The *Trivialisation* of an object  $X$  (of any type, even a construction), in symbols  ${}^0X$ , constructs simply  $X$  without the mediation of any other construction. *Compound* constructions, which consist of other constituents as well, are *Composition* and *Closure*. The *Composition*  $[F A_1 \dots A_n]$  is the operation of functional application. It  $v$ -constructs the value of the function  $f$  (*valuation*-, or  $v$ -, -constructed by  $F$ ) at a tuple argument  $A$  ( $v$ -constructed by  $A_1, \dots, A_n$ ), if the function  $f$  is defined at  $A$ , otherwise the *Composition* is  *$v$ -improper*, i.e., it *fails* to  $v$ -construct anything.<sup>7</sup> The *Closure*  $[\lambda x_1 \dots x_n X]$  spells out the instruction to  $v$ -construct a function by abstracting over the values of the variables  $x_1, \dots, x_n$  in the ordinary manner of the  $\lambda$ -calculus. Finally, higher-order constructions can be used twice over as constituents of composite constructions. This is achieved by a fifth construction called *Double Execution*,  ${}^2X$ , that behaves as follows: If  $X$   $v$ -constructs a construction  $X'$ , and  $X'$   $v$ -constructs an entity  $Y$ , then  ${}^2X$   $v$ -constructs  $Y$ ; otherwise  ${}^2X$  is  *$v$ -improper*, failing as it does to  $v$ -construct anything.

TIL constructions, as well as the entities they construct, all receive a type. The formal ontology of TIL is bi-dimensional; one dimension is made up of constructions, the other dimension encompasses non-constructions. On the ground level of the type hierarchy, there are non-constructional entities unstructured from the algorithmic point of view belonging to a *type of order 1*. Given a so-called *epistemic (or objectual) base* of *atomic types* ( $\mathfrak{o}$ -truth values,  $\mathfrak{t}$ -individuals,  $\mathfrak{\tau}$ -time moments/real numbers,  $\mathfrak{\omega}$ -possible worlds), the induction rule for forming functional types is applied: where  $\alpha, \beta_1, \dots, \beta_n$  are types of order 1, the set of partial map-

<sup>6</sup> See also Duží et al. (2009).

<sup>7</sup> As mentioned above, we treat functions as partial mappings, i.e., set-theoretical objects, unlike the *constructions* of functions.

pings from  $\beta_1 \times \dots \times \beta_n$  to  $\alpha$ , denoted  $'(\alpha \beta_1 \dots \beta_n)'$ , is a type of order 1 as well.<sup>8</sup> Constructions that construct entities of order 1 are *constructions of order 1*. They belong to a *type of order 2*, denoted  $'*_1'$ . The type  $*_1$  together with atomic types of order 1 serves as a base for the induction rule: any collection of partial mappings, type  $(\alpha \beta_1 \dots \beta_n)$ , involving  $*_1$  in their domain or range is a *type of order 2*. Constructions belonging to a type  $*_2$  that identify entities of order 1 or 2, and partial mappings involving such constructions, belong to a *type of order 3*. And so on *ad infinitum*.

The sense of an empirical expression is a *hyperintension*, i.e., a construction that produces a (possible world)  $(\alpha)$ -intension, where  $\alpha$ -intensions are members of type  $(\alpha\omega)$ , i.e., functions from possible worlds to an arbitrary type  $\alpha$ . On the other hand,  $(\alpha)$ -extensions are members of a type  $\alpha$ , where  $\alpha$  is not equal to  $(\beta\omega)$  for any  $\beta$ , i.e., extensions are not functions whose domain are possible worlds.

Intensions are frequently functions of a type  $((\alpha\tau)\omega)$ , i.e., functions from possible worlds to *chronologies* of the type  $\alpha$  (in symbols:  $\alpha_{\tau\omega}$ ), where a chronology is a function of type  $(\alpha\tau)$ .

Some important kinds of intensions are:

- *Propositions*, type  $o_{\tau\omega}$ . They are denoted by empirical sentences.
- *Properties of members of a type  $\alpha$* , or simply  *$\alpha$ -properties*, type  $(o\alpha)_{\tau\omega}$ .<sup>9</sup> General terms, some substantives, intransitive verbs ('student', 'walks') denote properties, mostly of individuals.
- *Relations-in-intension*, type  $(o\beta_1 \dots \beta_m)_{\tau\omega}$ . For example transitive empirical verbs ('like', 'worship'), also attitudinal verbs denote these relations.
- *$\alpha$ -roles*, also  *$\alpha$ -offices*, type  $\alpha_{\tau\omega}$ , where  $\alpha \neq (o\beta)$ . Frequently  $\iota_{\tau\omega}$ . Often denoted by concatenation of a superlative and a noun ('the highest mountain').

<sup>8</sup> TIL is an open-ended system. The above epistemic base  $\{o, \iota, \tau, \omega\}$  was chosen, because it is apt for natural-language analysis, but the choice of base depends on the area to be analysed. For instance, possible worlds and times are out of place in case of mathematics, and the base might consist of, e.g.,  $o$  and  $v$ , where  $v$  is the type of natural numbers.

<sup>9</sup> We model  $\alpha$ -sets and  $(\alpha_1 \dots \alpha_n)$ -relations by their characteristic functions of type  $(o\alpha)$ ,  $(o\alpha_1 \dots \alpha_n)$ , respectively. Thus an  $\alpha$ -property is an empirical function that dependently on states-of-affairs  $(\tau\omega)$  picks-up a set of  $\alpha$ -individuals, the population of the property.



An object  $A$  of a type  $\alpha$  is denoted ' $A/\alpha$ '. That a construction  $C/*_n v$ -constructs an object of type  $\alpha$  is denoted ' $C \rightarrow_v \alpha$ '. We use variables  $w, w_1, \dots$  as  $v$ -constructing elements of type  $\omega$  (possible worlds), and  $t, t_1, \dots$  as  $v$ -constructing elements of type  $\tau$  (times). If  $C \rightarrow_v \alpha_{\tau\omega}$   $v$ -constructs an  $\alpha$ -intension, the frequently used Composition of the form  $[[Cw]t]$ , the intensional descent of the  $\alpha$ -intension, is abbreviated ' $C_{wt}$ '.

We invariably furnish expressions with their procedural structured meanings, which are explicated as TIL constructions. The analysis of a sentence thus consists in discovering the logical construction encoded by a given sentence. The *TIL method of analysis* consists of three steps:<sup>10</sup>

- 1) *Type-theoretical analysis*, i.e., assigning types to the objects that receive mention in the analysed sentence.
- 2) *Synthesis*, i.e., combining the constructions of the objects *ad* (1) in order to construct the proposition of type  $\omega_{\tau\omega}$  denoted by the whole sentence.
- 3) *Type-Theoretical checking*.

To illustrate the method, let us first analyse the sentence "The King of France is watching TV" in the Strawsonian way. The sentence talks about the office of the King of France (topic) ascribing to the individual (if any) that occupies this office the property of watching TV (focus). Thus there is a presupposition that the King of France exist, i.e., that the office be occupied. If not, then the proposition denoted by the sentence has no truth-value.<sup>11</sup> This fact has to be revealed by our analysis. Here is how.

*Ad* (1).  $King\_of/(u)_{\tau\omega}$ : an empirical function that dependently on world/time  $\langle w, t \rangle$ -pairs assigns to an individual another individual (its king);  $France/v$ ;  $King\_of\_France/v_{\tau\omega}$ ;  $Watch/(o)_{\tau\omega}$ : the property of watching TV.<sup>12</sup>

<sup>10</sup> For details see, e.g., Materna – Duží (2005).

<sup>11</sup> On our approach this does not mean that the sentence is meaningless. The sentence has a sense, namely an instruction of how to evaluate in any possible world  $w$  at any time  $t$  its truth-conditions. Only if we evaluate these conditions in such a state-of-affairs where there is no King of France does the process of evaluation yield a truth-value gap.

<sup>12</sup> For the sake of simplicity I will analyse the predicate 'watching TV' as a semantically simple expression denoting the property *Watch*. To obtain a more detailed analysis, the property would be constructed by the Closure  $\lambda w \lambda t \lambda x [{}^0 Watch_{wt} x {}^0 TV]$ , where  $x \rightarrow v, TV/v, Watching/(o)_{\tau\omega}$ .

*Ad (2).* Now we combine *constructions* of the objects *ad (1)* in order to construct the proposition (of type  $o_{\tau_0}$ ) denoted by the whole sentence. Since we aim at discovering the *literal* analysis of the sentence, objects denoted by semantically simple expressions ‘the king of’, ‘France’ and ‘watching TV’ are constructed by their Trivialisations:  ${}^0King\_of$ ,  ${}^0France$ ,  ${}^0Watch$ . In order to construct the office *King\_of\_France*, we have to combine  ${}^0King\_of$  and  ${}^0France$ . The function *King\_of* must be extensionalised first *via* the Composition  ${}^0King\_of_{wt}$ , and the result is then applied to *France*; we get  $[{}^0King\_of_{wt} {}^0France] \rightarrow_v \iota$ . Abstracting over the values of *w* and *t* we obtain the Closure that constructs the office:  $\lambda w \lambda t [{}^0King\_of_{wt} {}^0France] \rightarrow \iota_{\tau_0}$ . But the property of watching TV cannot be ascribed to an individual office. Rather, it is ascribed to the individual (if any) occupying the office. Thus the office has to be subjected to intensional descent first:  $\lambda w \lambda t [{}^0King\_of_{wt} {}^0France]_{wt} \rightarrow \iota$ . The property itself has to be extensionalised as well, namely thus:  ${}^0Watch_{wt}$ . By Composing these two constructions, we obtain either a truth-value (**T** or **F**) or nothing, according as the King of France is or is not watching TV, or does not exist, respectively.<sup>13</sup> Finally, by abstracting over the values of the variables *w* and *t*, we construct the proposition:

$$\lambda w \lambda t [{}^0Watch_{wt} \lambda w \lambda t [{}^0King\_of_{wt} {}^0France]_{wt}].$$

This Closure can be equivalently  $\beta$ -reduced to

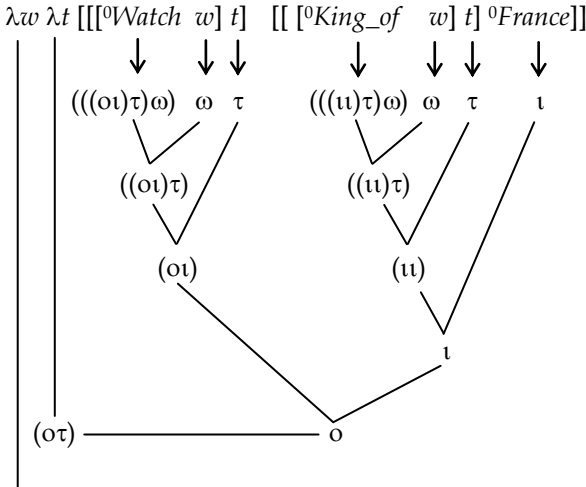
$$\lambda w \lambda t [{}^0Watch_{wt} [{}^0King\_of_{wt} {}^0France]].$$

*Gloss.* In *any* world at *any* time ( $\lambda w \lambda t$ ) do this: First, find out who is the King of France by applying the extensionalised attribute *King\_of* to *France* ( $[{}^0King\_of_{wt} {}^0France]$ ). If there is none, then terminate with a truth-value gap because the Composition  $[{}^0King\_of_{wt} {}^0France]$  is *v*-improper. Otherwise, check whether the so obtained individual has the property of watching TV ( $[{}^0Watch_{wt} [{}^0King\_of_{wt} {}^0France]]$ ). If so, then **T**, otherwise **F**.

*Ad (3).* By drawing a type-theoretical structural tree,<sup>14</sup> we check whether the particular constituents of the above Closure are combined in a type-theoretically correct way.

<sup>13</sup> For details on predication of properties see Jespersen (2008).

<sup>14</sup> See Duží – Materna (2005).



$((o\tau)\omega)$  the type of a proposition,  $o_{\tau\omega}$  for short.

So much for the method of analysis and the semantic schema of the logic of TIL.

### 3 The Topic-Focus Ambiguity

Now we are going to apply the formal TIL apparatus in order to propose a solution to the Strawsonian-Russellian dilemma. In other words, we are going to analyse the phenomena of presupposition and entailment connected with using definite descriptions, and I will show how the topic-focus distinction determines which of the two phenomena is the case.

When used in a communicative act, a sentence communicates something (the focus  $F$ ) about something (the topic  $T$ ). Thus the schematic structure of a sentence is  $F(T)$ . The topic  $T$  of a sentence  $S$  is often associated with a presupposition  $P$  of  $S$  such that  $P$  is entailed both by  $S$  and  $non-S$ . On the other hand, the clause in the focus usually triggers a mere entailment of some  $P$  by  $S$ . Schematically,

- (i)  $S \vDash P$  and  $non-S \vDash P$  ( $P$  is a presupposition of  $S$ );  
Corollary: If  $non-P$  then neither  $S$  nor  $non-S$  is true.
- (ii)  $S \vDash P$  and neither  $(non-S \vDash P)$  nor  $(non-S \vDash non-P)$  (mere entailment).

More precisely, the entailment relation obtains between hyperpropositions  $P, S$ , i.e., the meaning of  $P$  is entailed or presupposed by the

meaning of *S*. For the precise definition of entailment and presupposition, see Duží *et al.* (forthcoming, Section 1.5).

To give an example, consider the sentence “Our defeat was caused by John”.<sup>15</sup> There are two possible readings of this sentence. Either the sentence is about our defeat, conveying the snippet of information that it was caused by John. In such a situation the sentence is associated with the presupposition that we were defeated. Indeed, the negated form of the sentence, “Our defeat was not caused by John”, also implies that we were defeated. Thus ‘our defeat’ is the topic and ‘was caused by John’ the focus clause. On the other possible reading, the sentence is about the topic John, ascribing to him the property that he caused our defeat (focus). Now the scenario of truly asserting the negated sentence can be, for instance, the following. Though it is true that John has the reputation of being rather a bad player, Paul was in excellent shape and so we won. Or, another scenario is thinkable. We were defeated, only not because of John but because the whole team performed badly. Hence, that we were defeated is not presupposed by this reading, it is only entailed.

Since there are no rigorous grammatical rules to distinguish between the two variants, the input of our *logical* analysis is the result of a *linguistic* analysis, where the topic and focus of a sentence are made explicit.<sup>16</sup> In this paper I will mark the topic clause in italics. Thus the two readings of the above sentence are “*Our defeat* was caused by John” and “Our defeat was caused by *John*”.<sup>17</sup>

### 3.1 The Strawsonian vs. Russellian analysis

Above we analysed the sentence “The King of France is watching TV” on its perhaps most natural reading as predicating the property of watching TV (the focus) of the individual (if any) that is the present King of France (the topic).

<sup>15</sup> This and some other examples were taken from Hajičová (2008).

<sup>16</sup> For instance, the Prague linguistic school created The Prague Dependency Treebank for the Czech language, which contains a large amount of Czech texts with complex and interlink annotation on different levels. The tectogrammatical representation contains the logical structure of a sentence with topic-focus annotators. For details, see <http://ufal.mff.cuni.cz/pdt2.0/>.

<sup>17</sup> True, in this case we would most probably use the active form “*John* caused our defeat”.

Yet there is another, albeit less natural reading of the sentence. Imagine that the sentence is uttered in a situation where somebody asks “What about TV?”, and the answer is “Well, among those who are watching TV there is the King of France”. If you got such an answer, you would most probably protest, “This cannot be true, for there is no King of France now”. On such a reading the sentence is about TV, ascribing to it the property of being watched by the King of France. Thus we have:

Strawsonian reading: “The King of France is watching TV”

Russellian reading: “The King of France is watching TV”,

or perhaps a more natural passive rephrasing:

“TV is being watched by the King of France”.

The analysis of the former is as above:

(S)  $\lambda\omega\lambda t$  [ ${}^0\text{Watch}_{wt}$   $\lambda\omega\lambda t$  [ ${}^0\text{King\_of}_{wt}$   ${}^0\text{France}$ ] $_{wt}$ ]

The meaning of ‘the King of France’, viz.  $\lambda\omega\lambda t$  [ ${}^0\text{King\_of}_{wt}$   ${}^0\text{France}$ ], occurs in (S) with *de re* supposition, because the object of predication is the unique value of the office, not the office itself.<sup>18</sup> The two *de re* principles are, thus, valid. They are the principle of *existential presupposition* and the principle of *substitution of co-referential* expressions. Thus the following arguments are valid (though not sound):

“The King of France is/is not watching TV”

“The King of France exists”

“The King of France is watching TV”

“The King of France is Louis XVI”

“Louis XVI is watching TV”

Here are the proofs.<sup>19</sup>

<sup>18</sup> For details on *de dicto* vs. *de re* supposition, see Duží *et al.*, forthcoming, in particular Sections 1.5.2 and 2.6.2, and also Duží (2004).

<sup>19</sup> For an easier reading, throughout this paper I use infix notation without Trivialization when applying truth-value connectives and equality. Thus, for instance, instead of ‘ $[{}^0 \supset [{}^0 = [{}^0 5 \ 5]] [{}^0 = [n \ 01]]]$ ’ I will write ‘ $[[{}^0 5 = {}^0 5] \supset [n = {}^0 1]]$ ’.

(a) existential presupposition:

First, existence is here a property of an individual *office* rather than of some non-existing individual, whatever that would mean. Thus we have *Exist*/( $o\iota_{\tau\omega}$ ) $_{\tau\omega}$ . To prove the validity of the first argument, we define *Exist*/( $o\iota_{\tau\omega}$ ) $_{\tau\omega}$  as the property of an office's being occupied in a given world/time pair:

$${}^0\text{Exist} =_{of} \lambda w \lambda t \lambda c [{}^0\exists \lambda x [x = c_{wt}]], \text{ i.e., } [{}^0\text{Exist}_{wt} c] =_o [{}^0\exists \lambda x [x =_i c_{wt}]]$$

*Types*:  $\exists/(o(o\iota))$ : the class of non-empty classes of individuals;  $c \rightarrow_v \iota_{\tau\omega}$ ;  $x \rightarrow_v \iota$ ;  $=_o/(ooo)$ : the identity of truth-values;  $=_{of}/(o(o\iota_{\tau\omega})_{\tau\omega}(o\iota_{\tau\omega})_{\tau\omega})$ : the identity of individual-office properties.

Let  $=_i/(o\iota)$  be the identity of individuals,  $x \rightarrow \iota$ , *Louis*/ $\iota$ , *Empty*/( $o(o\iota)$ ) the singleton containing the empty set of individuals and *Improper*/( $o*_1$ ) $_{\tau\omega}$  the property of constructions of being *v*-improper in a given  $\langle w, t \rangle$ -pair, the other types as above. Then in any  $\langle w, t \rangle$  the following proof steps are truth-preserving:

- 1)  $[{}^0\text{Watch}_{wt} \lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}]$  assumption
- 2)  $\neg[{}^0\text{Improper}_{wt} [{}^0\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]]_{wt}]$   
by definition of Composition
- 3)  $\neg[{}^0\text{Empty} \lambda x [x =_i [{}^0\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]]_{wt}]]$  obvious from (2)
- 4)  $[{}^0\exists \lambda x [x =_i [{}^0\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]]_{wt}]]$  existential generalization
- 5)  $[{}^0\text{Exist}_{wt} [{}^0\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]]]$  by def. of *Exist*.

The proof from  $\neg[{}^0\text{Watch}_{wt} \lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}]$  is analogous.

(b) substitution:

- 1)  $[{}^0\text{Watch}_{wt} \lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}]$  assumption
- 2)  $[{}^0\text{Louis} =_i \lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}]$  assumption
- 3)  $[{}^0\text{Watch}_{wt} {}^0\text{Louis}]$  substitution of identicals

On the other reading, the sentence is not associated with the presupposition that the present King of France exist, because 'the King of France' occurs now in the focus clause. The truth-conditions of the Russellian "TV is being watched by the King of France" are these:

- True, if TV is being watched by the King of France
- False, if among those who are watching TV there is no King of France (either because the present King of France does not exist or because the King of France is busy with some other activity).

Thus the two readings have different truth-conditions, and they are not equivalent, albeit they are co-entailing. The reason is this. Trivially, a valid argument is *truth-preserving from premises to conclusion*. However, due to partiality, the entailment relation may fail to be *falsity-preserving from conclusion to premises*. As a consequence, if  $A, B$  are constructions of propositions such that  $A \vDash B$  and  $B \vDash A$ , then  $A, B$  are not necessarily equivalent in the sense of constructing the same proposition. The propositions they construct may not be identical, though they take the truth-value **T** at exactly the same world/times, because they may differ in such a way that in some  $\langle w, t \rangle$ -pair(s) one takes the value **F** while the other is undefined.

Russellian vs. Strawsonian analysis is an example of such co-entailing yet non-equivalent hyperpropositions. The Russellian rephrasing of the sentence

(S<sub>1</sub>) “The King of France is watching TV”

would be sentence S<sub>2</sub>:

(S<sub>2</sub>) “There is a unique individual such that he is the King of France and he is watching TV.”

The TIL analyses of these two sentences come down to these Closures:<sup>20</sup>

(S<sub>1</sub>′)  $\lambda w \lambda t [{}^0\text{Watch}_{wt} \lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}]$

(S<sub>2</sub>′)  $\lambda w \lambda t [{}^0\exists \lambda x [x = [\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]_{wt}] \wedge [{}^0\text{Watch}_{wt} x]]]$ .

Now (S<sub>1</sub>′)  $\vDash$  (S<sub>2</sub>′) and (S<sub>2</sub>′)  $\vDash$  (S<sub>1</sub>′), but the two are *not equivalent*. If the proposition constructed by (S<sub>1</sub>′) is true then so is the proposition constructed by (S<sub>2</sub>′), and *vice versa*. But, for instance, in the actual world now the proposition constructed by (S<sub>1</sub>′) has *no truth-value* whereas the proposition constructed by (S<sub>2</sub>′) is simply *false*. This proposition is false if either the King of France does not exist, or he is not watching TV. Moreover, the TIL analysis of the ‘Russellian rephrasing’ does not deprive ‘the King of France’ of its meaning. The meaning is invariably, in all contexts, the Closure  $\lambda w \lambda t [{}^0\text{King\_of}_{wt} {}^0\text{France}]$ .

<sup>20</sup> Note that it is not necessary to explicitly specify the uniqueness of the King of France, as it is given by the meaning of the expression ‘the King of France’, and thus by the type of the denoted entity, *viz.*  $t_{\text{co}}$ .

Thus we might be content with ( $S_2'$ ) and assign this construction to the sentence

(R) “TV is being watched by the King of France”

as its meaning. Yet we should not be content with ( $S_2'$ ). The reason is this. Besides depriving the definite description ‘the King of France’ of its self-contained meaning, Russell’s analysis has another defect. The existential quantifier  $\exists$  and conjunction  $\wedge$  do not receive mention in the sentence (R). Thus assigning ( $S_2'$ ) to (R) as its meaning does not comply with Carnap’s principle of subject matter, which says, roughly, that only those entities that receive mention in the sentence can become constituents of its meaning.<sup>21</sup> In other words, the sentence ( $S_2$ ), though sharing its truth-conditions with (R), is too loose a reformulation of the original sentence.

However, the remedy is easy. From the logical point of view, the two readings differ in the way their respective negated form is obtained. Whereas the Strawsonian negated form is “The *King of France* is not watching TV”, which obviously lacks a truth-value if the King of France does not exist, the Russellian negated form is simply “It is not true that the King of France is watching TV”, which is true in those  $\langle w, t \rangle$ -pairs where the office is not occupied. Thus in the Strawsonian case the property of not watching TV is ascribed to the individual, if any, that occupies the King’s office. The meaning of ‘the King of France’ occurs with *de re* supposition, as we have seen above. On the other hand, in the Russellian case the property of not being true is ascribed to the whole proposition that the King is watching TV, and thus (the same meaning of) the description ‘the King of France’ occurs with *de dicto* supposition. And it is a brute fact that *de re* and *de dicto* readings are not equivalent in general, in particular when *partiality* is involved.<sup>22</sup>

Russell argued for his theory in (1905, p. 3), saying:

The evidence for the above theory is derived from the difficulties which seem unavoidable if we regard denoting phrases as standing for genuine constituents of the propositions in whose verbal expressions they occur. Of the possible theories which admit such constituents the simplest is that of Meinong. This theory regards any grammatically correct denoting phrase as standing for an *object*. Thus ‘the present King of France’, ‘the round square’, etc., are

<sup>21</sup> See Carnap (1947, §24.2, §26).

<sup>22</sup> See Duží (2004).



supposed to be genuine objects. It is admitted that such objects do not *subsist*, but nevertheless they are supposed to be objects. This is in itself a difficult view; but the chief objection is that such objects, admittedly, are apt to infringe the law of contradiction. It is contended, for example, that the existent present King of France exists, and also does not exist; that the round square is round, and also not round, etc. But this is intolerable; and if any theory can be found to avoid this result, it is surely to be preferred.

Russell did avoid the intolerable result that the King of France both does and does not exist, but the price he paid is too high. TIL, as a hyperintensional, typed *partial*  $\lambda$ -calculus, is in a much better position to solve the problem. We simply ascribe the property of being true to the whole proposition.

To do so we use the propositional property  $True/(oo_{\tau_0})_{\tau_0}$ , which returns **T** for those  $\langle w, t \rangle$ -pairs at which the argument proposition is true, and **F** in all the remaining cases. There are two other propositional properties *False*, and *Undef*, all of type  $(oo_{\tau_0})_{\tau_0}$ . The three properties are defined as follows. Let  $P$  be a propositional construction  $(P/*_n \rightarrow o_{\tau_0})$ . Then

- $[{}^0True_{wt} P]$   $v$ -constructs the truth-value **T** iff  
 $P_{wt} v$ -constructs **T**, otherwise **F**.  
 $[{}^0False_{wt} P]$   $v$ -constructs the truth-value **T** iff  
 $[\neg P_{wt}] v$ -constructs **T**, otherwise **F**.  
 $[{}^0Undef_{wt} P]$   $v$ -constructs the truth-value **T** iff  
 $[\neg[{}^0True_{wt} P] \wedge \neg[{}^0False_{wt} P]] v$ -constructs **T**, otherwise **F**.

Thus we have:

$$\begin{aligned} \neg[{}^0Undef_{wt} P] &= [[{}^0True_{wt} P] \vee [{}^0False_{wt} P]] \\ \neg[{}^0True_{wt} P] &= [[{}^0False_{wt} P] \vee [{}^0Undef_{wt} P]] \\ \neg[{}^0False_{wt} P] &= [[{}^0True_{wt} P] \vee [{}^0Undef_{wt} P]] \end{aligned}$$

Hence, though we work with truth-value gaps, we do not work with a third truth-value, and our logic is in this weak sense bivalent.

Now the analysis of the sentence (R) comes down to this construction:

$$(R') \quad \lambda w \lambda t [{}^0True_{wt} \lambda w \lambda t [{}^0Watch_{wt} \lambda w \lambda t [{}^0King\_of_{wt} {}^0France]_{wt}]]$$

Neither (R') nor its negation

$$(R' \text{ _neg}) \quad \lambda w \lambda t \neg[{}^0True_{wt} \lambda w \lambda t [{}^0Watch_{wt} \lambda w \lambda t [{}^0King\_of_{wt} {}^0France]_{wt}]]$$

entails that the King of France exists, which is just as it should be. ( $R'$ \_neg) constructs the proposition *non-P* that takes the truth-value **T** if the proposition that the King of France is watching *TV* takes the value **F** (because the King of France is not watching *TV*) or is undefined (because the King of France does not exist).

Consider now another group of sample sentences:

- (2) *The King of France* visited London yesterday.  
 (2') *The King of France* did not visit London yesterday.

The sentences (2) and (2') talk about the (actual and current) King of France (the topic), ascribing to him the property of having (not having) visited London yesterday (the focus). Thus both sentences share the presupposition that the King of France actually exist *now*. If this presupposition fails to be satisfied, then none of the propositions expressed by (2) and (2') has a truth-value. The situation is different in case of sentences (3) and (3'):

- (3) *London* was visited by the King of France yesterday.  
 (3') *London* was not visited by the King of France yesterday.

Now the property (the focus) of having been visited by the King of France yesterday is predicated of London (the topic). The existence of the King of France (now) is not presupposed by (3), and thus also not by (3'), of course. The sentences can be read as "Among the visitors of London yesterday was (was not) the King of France". The existence of the King of France *yesterday* is *entailed* only by (3), but *not presupposed*.

Our analyses respect these conditions. Let *Yesterday*/ $((\sigma\tau)\tau)$  be the function that associates a given time  $t$  with the time interval that is yesterday with respect to  $t$ ; *Visit*/ $(\sigma\iota)_{\tau\omega}$ ; *King\_of*/ $(\iota)_{\tau\omega}$ ; *France*/ $\nu$ ;  $\exists^{\tau}/(\sigma(\sigma\tau))$ : the existential quantifier that assigns to a given set of times the truth-value **T** if the set is non-empty, otherwise **F**. In what follows I will use an abbreviated notation without Trivialisation, writing ' $\exists x A$ ' instead of ' $[^0\exists^{\tau}\lambda x A]$ ', when no confusion can arise.

The analyses of sentences (2), (2') come down to

- (2\*)  $\lambda\omega\lambda t [\lambda x \exists t' [ [ [^0\text{Yesterday } t] t'] \wedge$   
 $[^0\text{Visit}_{\omega t'} x \ ^0\text{London}] ] [^0\text{King\_of}_{\omega t} \ ^0\text{France}] ]$   
 (2'\*)  $\lambda\omega\lambda t [\lambda x [\exists t' [ [ [^0\text{Yesterday } t] t'] \wedge$   
 $- [^0\text{Visit}_{\omega t'} x \ ^0\text{London}] ] [^0\text{King\_of}_{\omega t} \ ^0\text{France}] ]$

In such a  $\langle w, t \rangle$ -pair at which the King of France does not exist both the propositions constructed by (2\*) and (2'\*) have no truth-value, because the Composition  $[{}^0\text{King\_of\_}w_t {}^0\text{France}]$  is  $v$ -improper. We have the Strawsonian case, the meaning of 'King of France' occurring with *de re* supposition, and the King's existence being presupposed.

On the other hand, the sentences (3), (3') express

$$(3^*) \quad \lambda w \lambda t \exists t' [ [ [ {}^0\text{Yesterday } t ] t' ] \wedge [ {}^0\text{Visit}_{w,t'} [ {}^0\text{King\_of\_}w_t {}^0\text{France} ] {}^0\text{London} ] ]$$

$$(3'^*) \quad \lambda w \lambda t \exists t' [ [ [ {}^0\text{Yesterday } t ] t' ] \wedge \neg [ {}^0\text{Visit}_{w,t'} [ {}^0\text{King\_of\_}w_t {}^0\text{France} ] {}^0\text{London} ] ]$$

Now at such a  $\langle w, t \rangle$ -pair at which the proposition constructed by (3\*) is true, the Composition  $\exists t' [ [ [ {}^0\text{Yesterday } t ] t' ] \wedge [ {}^0\text{Visit}_{w,t'} [ {}^0\text{King\_of\_}w_t {}^0\text{France} ] {}^0\text{London} ] ]$   $v$ -constructs the truth-value **T**. This means that the second conjunct  $v$ -constructs **T** as well and the Composition  $[{}^0\text{King\_of\_}w_t {}^0\text{France}]$  is not  $v$ -improper. Thus the King of France *existed at some time*  $t'$  belonging to *yesterday*. On the other hand, if the King of France did not exist at any time yesterday, then the Composition  $[{}^0\text{King\_of\_}w_t {}^0\text{France}]$  is  $v$ -improper for any  $t'$  belonging to yesterday. Thus the time interval  $v$ -constructed by  $\lambda t' [ [ [ {}^0\text{Yesterday } t ] t' ] \wedge [ {}^0\text{Visit}_{w,t'} [ {}^0\text{King\_of\_}w_t {}^0\text{France} ] {}^0\text{London} ] ]$ , as well as by  $\lambda t' [ [ [ {}^0\text{Yesterday } t ] t' ] \wedge \neg [ {}^0\text{Visit}_{w,t'} [ {}^0\text{King\_of\_}w_t {}^0\text{France} ] {}^0\text{London} ] ]$ , is empty, and the existential quantifier takes this interval to the truth-value **F**. This is as it should be, because (3\*) *only implies the existence* of the King of France *yesterday* but *does not presuppose* it. We have the Russellian case. The meaning of the definite description 'the King of France' occurs with *de dicto* supposition in (3) and (3').<sup>23</sup> The King's existence is not presupposed by (3) or (3'), only entailed by (3).

### 3.2 General analytic schema

Up until now we have utilised the singularity of the office of King of France, which is a function of type  $\iota_{w_0}$ . If the King of France does not exist in some world  $W$  at some time  $T$ , the office is not occupied and the function does not have a value in  $W$  at  $T$ . Due to the partiality of the office constructed by  $\lambda w \lambda t [{}^0\text{King\_of\_}w_t {}^0\text{France}]$  and the principle of com-

<sup>23</sup> More precisely, the meaning of 'the King of France' occurs with *de dicto* supposition with respect to the temporal parameter  $t$ .

positionality, the respective analyses construct purely partial propositions associated with some presupposition, as desired.

However, we encounter the phenomenon of topic-focus and the associated *de dicto* – *de re* ambivalence also in sentences containing general terms. Consider now another pair of sentences differing only in terms of topic-focus articulation:

- (4) The *global financial and economic crisis* was caused by the Bank of America.  
 (5) The *Bank of America* caused the global financial and economic crisis.

While (4) not only entails but also presupposes that there be a global financial and economic crisis, the truth-conditions of (5) are different, as our analysis clarifies.

First, (4) as well as (4'),

- (4') The *global financial and economic crisis* was not caused by Bank of America.

are about the global crisis, and that there is a global financial and economic crisis is not only entailed but also presupposed by both the sentences.

As we have seen above, the meaning of a sentence is a procedure producing a proposition, i.e. an object of type  $o_{\tau\omega}$ . Execution of this procedure in any world/time yields a truth-value **T**, **F** or nothing. Thus we can conceive the sense of a sentence as an instruction on how to evaluate its truth-conditions in any world/time. The instruction encoded by (4) formulated in logician's English is this:

*If there is a global crisis then return T or F according as the crisis was caused by the Bank of America, else fail (to produce a truth-value).*

Since every TIL analysis is fully compositional, we first need to analyse particular constituents of this instruction, and then combine these constituents into the construction expressed by the sentence. As always, we start with assigning types to the objects that receive mention in the sentence. Simplifying a bit, let the objects be:

- *Crisis*/ $o_{\tau\omega}$ : the proposition that there is a global financial and economic crisis;

- $Cause/(o\iota o_{\tau o})_{\tau o}$ : the relation-in-intension between an individual and a proposition which has been caused to be true by the individual;
- $Bank\_of\_America/\iota_{\tau o}$ : the individual office occupiable by a corporation belonging to the American financial institutions.

A schematic analysis of (4) comes down to this procedure:

(4s)  $\lambda\omega\lambda t$  [*if*  ${}^0Crisis_{wt}$  *then*  ${}^0True_{wt}$   $\lambda\omega\lambda t$  [ ${}^0Cause_{wt}$   ${}^0Bank\_of\_America_{wt}$   ${}^0Crisis$ ]] *else* Fail]

Here we again use the propositional property *True* in the then-clause, because this clause occurs in the focus of the sentence, and thus with *de dicto* supposition. The existence of the Bank of America is not presupposed.

So far so good; yet there is a problem of how to analyse the connective *if-then-else*. There has been much dispute over the semantics of ‘if-then-else’ among computer scientists. We cannot simply apply material implication,  $\supset$ . For instance, it might seem that the instruction expressed by “If  $5=5$  then output 1, else output the result of 1 divided by 0” received the analysis

$$[[[{}^05=05] \supset [n={}^01]] \wedge \neg[{}^05=05] \supset [n=[{}^0Div\ 01\ 00]]],$$

where  $n$  is the output number. But the output of the above procedure should be the number 1 because the *else* clause is never executed. However, due to the strict principle of compositionality that TIL observes, the above analysis fails to produce anything, the construction being improper. The reason is this. The Composition  $[{}^0Div\ 01\ 00]$  does not produce anything: it is improper because the division function takes no value at the argument  $\langle 1, 0 \rangle$ . Thus the Composition  $[n = [{}^0Div\ 01\ 00]]$  is  $v$ -improper for any valuation  $v$ , because the identity relation  $=$  does not receive an argument, and so any other Composition containing the improper Composition  $[{}^0Div\ 01\ 00]$  as a constituent also comes out  $v$ -improper. The underlying principle is that partiality is being strictly propagated up. This is the reason why the *if-then-else* connective is often said to be a non-strict function.

However, there is no cogent reason to settle for non-strictness. I suggest applying a mechanism known in computer science as *lazy evaluation*. The *procedural* semantics of TIL operates smoothly even at the level of constructions. Thus it enables us to specify a strict definition of *if-then-else* that meets the compositionality constraint. The analysis of “If  $P$  then

$C_1$ , else  $C_2$ " is a procedure that decomposes into two phases. First, on the basis of the condition  $P$ , select one of  $C_1$ ,  $C_2$  as the procedure to be executed. Second, execute the selected procedure.

The first phase, *viz.* the selection, is realized by the Composition

$${}^0\iota\lambda c [[P \supset [c=^0C]] \wedge [\neg P \supset [c=^0D]]].$$

The Composition  $[[P \supset [c=^0C]] \wedge [\neg P \supset [c=^0D]]]$   $v$ -constructs  $\mathbf{T}$  in two cases. If  $P$   $v$ -constructs  $\mathbf{T}$  then the variable  $c$  receives as its value the *construction*  $C$ , and if  $P$   $v$ -constructs  $\mathbf{F}$  then the variable  $c$  receives the *construction*  $D$  as its value. In either case the set  $v$ -constructed by  $\lambda c [[P \supset [c=^0C]] \wedge [\neg P \supset [c=^0D]]]$  is a singleton. Applying the singulariser  $\iota$  to this set returns as its value the only member of the set, i.e., either the construction  $C$  or  $D$ .

Second, the chosen construction  $c$  is executed. As a result, the schematic analysis of "If  $P$  then  $C$  else  $D$ " turns out to be

$$(*) \quad {}^2[{}^0\iota\lambda c [[P \supset [c=^0C]] \wedge [\neg P \supset [c=^0D]]]].$$

Types:  $P \rightarrow o$  (the condition of the choice between the execution of  $C$  or  $D$ );  $C, D / *_{*n}$ ; variable  $c \rightarrow_v *_{*n}$ ;  $\iota / (*_n(o*_n))$ : the singulariser function that associates a singleton set of constructions with the only construction that is an element of this singleton, and which is otherwise (i.e., if the set is empty or many-valued) undefined.

Note that we do need a hyperintensional, procedural semantics here. First of all, we need a variable  $c$  ranging over constructions. Moreover, the evaluation of the first phase does not involve the execution of the constructions  $C$  and  $D$ . These constructions are only arguments of other constructions.

Returning to the analysis of (4), in our case the condition  $P$  is that there be a crisis, i.e.,  ${}^0Crisis_{wt}$ . The construction  $C$  that is to be executed if  $P$  yields  $\mathbf{T}$  is  $[{}^0True_{wt} \lambda w \lambda t [{}^0Cause_{wt} {}^0Bank\_of\_America_{wt} {}^0Crisis]]$ , and if  $P$  yields  $\mathbf{F}$  then *no* construction is to be selected. Thus the analysis of the sentence (4) comes down to this Closure:

$$(4^*) \quad \lambda w \lambda t {}^2[{}^0\iota\lambda c [[{}^0Crisis_{wt} \supset [c = {}^0[{}^0True_{wt} \lambda w \lambda t [{}^0Cause_{wt} {}^0Bank\_of\_America_{wt} {}^0Crisis]]]] \wedge [\neg {}^0Crisis_{wt} \supset {}^0\mathbf{F}]]]$$

The evaluation of (4\*) in any world/time pair  $\langle w, t \rangle$  depends on whether the presupposition  ${}^0Crisis_{wt}$  is true in  $\langle w, t \rangle$ . If true, then the singleton  $v$ -constructed by  $\lambda c [ \dots ]$  contains as the only construction the Composi-

tion [ ${}^0\text{True}_{wt} \lambda w \lambda t [{}^0\text{Cause}_{wt} {}^0\text{Bank\_of\_America}_{wt} {}^0\text{Crisis}]$ ], which is afterwards executed to returns **T** or **F**, according as the Bank of America caused the crisis. If false, then the second conjunct in  $\lambda c [\dots]$  comes down to [ ${}^0\text{T} \supset {}^0\text{F}$ ] and thus we get  $\lambda c {}^0\text{F}$ . The  $v$ -constructed set is *empty*. Hence,  ${}^2[\lambda c {}^0\text{F}]$  is  $v$ -improper, that is the Double Execution *fails* to produce a truth-value.

To generalise, an *analytic schema of an (empirical) sentence S associated with a presupposition P* is a procedure of the form

If  $P$  then  $S$  else *Fail*.

The corresponding schematic TIL construction is

(\*\*)  $\lambda w \lambda t {}^2[{}^0\lambda c [[P_{wt} \supset [c = {}^0S_{wt}]] \wedge [\neg P_{wt} \supset {}^0\text{F}]]]$ .

The truth-conditions of the other reading, i.e. the reading of (5)

(5) “The *Bank of America* caused the global financial and economic crisis”

are different.

Now the sentence (5) is about the Bank of America (topic), ascribing to this corporation the property that it caused the crisis (focus). Thus the scenario of truly asserting that (5) is *not true* can be, for instance, this. Though it is true that the Bank of America played a major role in risky investments in China, the President of USA played a positive role in enhancing financial market transparency and passed new laws that prevented a global crisis from arising. Or, a less optimistic scenario is thinkable. The global financial and economic crisis is not because of the Bank of America’s bad investments but because in the era of globalisation the market economy is unpredictable, hence uncontrollable.

Hence, that there is a crisis is not presupposed by (5), and its analysis is this Closure:

(5\*)  $\lambda w \lambda t [{}^0\text{Cause}_{wt} {}^0\text{Bank\_of\_America}_{wt} {}^0\text{Crisis}]$

Note that since the meaning of ‘Bank of America’ occurs with *de re* supposition now, (5) presupposes the existence of the Bank of America, while the existence of the crisis is not presupposed. Yet, if (5) is true, then the existence of the crisis can be validly inferred. To capture such truth-conditions, we need to refine the analysis.

A plausible explication of this phenomenon is this:  $x$  is a cause of a proposition  $p$  iff  $p$  is true and if so then  $x$  affected  $p$  so that to become true. Schematically,

$$\lambda\omega\lambda t [{}^0\text{Cause}_{wt} x p] = \lambda\omega\lambda t [p_{wt} \wedge [p_{wt} \supset [{}^0\text{Affect}_{wt} x p]]].$$

Types: *Cause*, *Affect* /  $(\text{o}\alpha\text{o}_{\tau\text{o}})_{\tau\text{o}}$ ;  $x \rightarrow \alpha$ ,  $\alpha$ : any type;  $p \rightarrow \text{o}_{\tau\text{o}}$ .

If  $x$  is not a cause of  $p$ , then either  $p$  is not true or  $p$  is true but  $x$  did not affect  $p$  such as to become true:

$$\lambda\omega\lambda t \neg[{}^0\text{Cause}_{wt} x p] = \lambda\omega\lambda t [\neg p_{wt} \vee [p_{wt} \wedge \neg[{}^0\text{Affect}_{wt} x p]]].$$

Applying such an explication to (5), we get

$$(5^{**}) \quad \lambda\omega\lambda t [{}^0\text{Crisis}_{wt} \wedge [{}^0\text{Crisis}_{wt} \supset [{}^0\text{Affect}_{wt} {}^0\text{Bank\_of\_America}_{wt} {}^0\text{Crisis}]]],$$

entailing that there is a crisis, which is the desired (logical, though not economic) outcome.

A similar phenomenon also crops up in the case of seeking and finding. Imagine one is referring to the tragedy in Dallas, November 22, 1963, by “The police were seeking the murderer of JFK but never found him”. The sentence is again ambiguous due to a difference in topic-focus articulation, as evidenced by (6) and (7):

- (6) The *police* were seeking the murderer of JFK but never found him.  
 (7) The police were seeking *the murderer of JFK* but never found him.

The existence of the murderer of JFK is not presupposed by (6), unlike (7). The sentence (6) can be true in such states-of-affairs where JFK was not murdered, unlike the sentence (7). The latter can be reformulated in a less ambiguous way as “*The murderer of JFK* was looked for by the police but never found”. This sentence expresses the construction

$$(7^*) \quad \lambda\omega\lambda t [[{}^0\text{Look\_for}_{wt} {}^0\text{Police} [\lambda\omega\lambda t [{}^0\text{Murderer\_of}_{wt} {}^0\text{JFK}]]_{wt}] \wedge \neg[{}^0\text{Find}_{wt} {}^0\text{Police} [\lambda\omega\lambda t [{}^0\text{Murderer\_of}_{wt} {}^0\text{JFK}]]_{wt}]].$$

Types: *Look\_for*, *Find*<sup>l</sup> /  $(\text{o}\text{u})_{\tau\text{o}}$ ; *Police* /  $\text{v}$ ; *Murderer\_of* /  $(\text{u})_{\tau\text{o}}$ ; *JFK* /  $\text{t}$ .<sup>24</sup>

<sup>24</sup> For the sake of simplicity, past tense and anaphoric reference are ignored. For a more detailed analysis of this kind of seeking and finding, see, for instance, Duží (2008) or Duží *et al.*, forthcoming, Chapter 5.



On the other hand, the analysis of (6) relates the police to the *office* of the murderer rather than to its holder. The police primarily aim to find out who the murderer is. Thus we have *Seek*,  $Find^S/(\text{ou}_{\tau\omega})_{\tau\omega}$ ; and (6) expresses:

$$(6^*) \quad \lambda\omega\lambda t \left[ \left[ {}^0Seek_{wt} \text{ } {}^0Police \left[ \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \right] \wedge \right. \\ \left. \neg \left[ {}^0Find^S_{wt} \text{ } {}^0Police \left[ \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \right] \right].$$

If the police did not find the murderer then either the murderer did not exist or the murderer existed but the search was not successful. However, if the foregoing search was successful, then it is true that police found the murderer:

$$\lambda\omega\lambda t \left[ {}^0Find^S_{wt} \text{ } {}^0Police \left[ \lambda\omega\lambda t \left[ {}^0Murder\_of_{wt} \text{ } {}^0JFK \right] \right] \right]$$

and the murderer existed. Hence, a successful search, i.e. *finding* after a foregoing search, also *triggers an existential commitment*:

$$\frac{\lambda\omega\lambda t \left[ {}^0Find^S_{wt} \text{ } {}^0Police \left[ \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \right]}{\lambda\omega\lambda t \left[ {}^0Exist_{wt} \left[ \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \right]}$$

In order to render this entailment, we explicate *finding after a foregoing search* in a manner similar to *causing* ( $x \rightarrow v$ ;  $c \rightarrow \iota_{\tau\omega}$ ;  $Success\_Search/(\text{ou}_{\tau\omega})_{\tau\omega}$ ):

$$\lambda\omega\lambda t \left[ {}^0Find^S_{wt} x c \right] = \\ \lambda\omega\lambda t \left[ \left[ {}^0Exist_{wt} c \right] \wedge \left[ \left[ {}^0Exist_{wt} c \right] \supset \left[ {}^0Success\_Search_{wt} x c \right] \right] \right] \\ \lambda\omega\lambda t \neg \left[ {}^0Find^S_{wt} x c \right] = \\ \lambda\omega\lambda t \left[ \neg \left[ {}^0Exist_{wt} c \right] \vee \left[ \left[ {}^0Exist_{wt} c \right] \wedge \neg \left[ {}^0Success\_Search_{wt} x c \right] \right] \right].$$

Thus the analysis of such an explication of the sentence “The *police* found the murderer of JFK” comes down to this Closure:

$$\lambda\omega\lambda t \left[ \left[ {}^0Exist_{wt} \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \wedge \right. \\ \left. \left[ \left[ {}^0Exist_{wt} \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \supset \right. \right. \\ \left. \left. \left[ {}^0Success\_Search_{wt} \text{ } {}^0Police \lambda\omega\lambda t \left[ {}^0Murderer\_of_{wt} \text{ } {}^0JFK \right] \right] \right] \right]$$

From this analysis one can validly infer that the murderer exists and that the search was successful, just as we ought to be able to. And if the so constructed proposition is not true, then the murderer does not exist or the murder does exist, only the search did not meet with success.

## 4 Concluding Remarks

In this paper I demonstrated the semantic character of the ambivalence concerning the topic-focus articulation of sentences. Using the procedural semantics of TIL, we were able to provide rigorous analyses such that sentences differing only in their topic-focus articulation are assigned different constructions producing different propositions and having different consequences.

We showed that a definite description occurring in the topic of a sentence with *de re* supposition corresponds to the Strawsonian analysis, while a definite description occurring in the focus with *de dicto* supposition corresponds to the Russellian analysis. While the clause standing in the topic generates the case of a presupposition, a focus-clause usually entails rather than presupposes another proposition.

Moreover, the proposed analysis of Russellian descriptions does not deprive the description of meaning. Just the opposite; 'the *F*' receives a context-invariant meaning. I also demonstrated that Donnellan-style referential and attributive uses of an occurrence of 'the *F*' does not bring about a shift of meaning of 'the *F*'. Instead, one and the same context-invariant meaning is a constituent of different procedures that behave in different ways. Thus both Russellian opponents and proponents are partly right and partly wrong, and Strawson was right concerning the case of using 'the *F*' with *de re* supposition in the topic of a sentence.

The input for our method is the output of a linguistic annotation providing labels for the topic-focus articulation. The fine-grained hyper-intensional method of analysis as presented in this paper can contribute to disambiguation of a sentence by making these hidden features explicit and logically tractable. In case there are more non-equivalent senses of a sentence we furnish the sentence with different meanings. Thus in my opinion theoretical linguistics and logic must collaborate and walk hand in hand.

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