



BOOK REVIEWS

About a mature theory of Fregean sense

MARIE DUŽÍ, BJØRN JESPERSEN, and PAVEL MATERNA: **Procedural Semantics for Hyperintensional Logic. Foundations and Applications of Transparent Intentional Logic**, vol. 17 of series *Logic, Epistemology, and the Unity of Science*, Springer, Dordrecht, Heidelberg, London, New York, 2010; xiii+552 pages, ISBN 978-90-481-8811-6, e-ISBN 978-90-481-8812-3. DOI: [10.1007/978-90-481-8812-3](https://doi.org/10.1007/978-90-481-8812-3)

The book develops a theory of Fregean sense to a mature form. It consists of only five chapters, which is perhaps surprising given its volume. The first chapter, “A programme of general semantics”, describes the philosophical foundations of procedural semantics informally and then presents the technical fundamentals of this programme. This chapter is crucial for the comprehension of the book, as without knowing its content the reader is not able to understand almost anything of the rest of the book. In the second chapter *concepts* are introduced and many issues typically connected with concepts are solved and explained, such as synonymy, empirical vs. mathematical concepts (an important distinction), anti-actualism, different kinds of context, and the *de re/de dicto* distinction. The third chapter is concerned mainly with definite descriptions, proper names, pragmatically incomplete meanings and anaphora. In the fourth chapter an original concept of *requisite* is introduced and applied to the resolution of such problems as: intensional essentialism, property modification, necessity and counterfactuals. The last chapter, entitled “Attitudes and information”, concerns propositional attitudes, notional attitudes, ‘quantifying-in’, information and inference. It is primarily a book devoted to the philosophy of language and only secondarily to the



philosophy of logic. I find the book to be one of the most important works of twentieth-century philosophy, even though it was released at the beginning of the twenty-first century, since it develops a significant idea stemming from the nineteenth century (Frege's *Sinn*) and expands it as a whole into a mature form.

The main ideas of the book are based on a very special understanding of concepts. There are two important points concerning *concepts*.¹ The first is that the term 'concept' has been used by many philosophers, past and present, especially after the *subjective turn* originating with Locke and Descartes, and is constantly in use in the sciences. However, a satisfactory explanation of what concepts are has still not been given. Although almost all of the particular concepts considered and used in a concrete scientific discipline have been defined, the very concept of *konzept* has not. The second point is that some philosophers and thinkers deny the independent existence of concepts. Some of them go so far as to claim that the existence of such entities is only apparent, or that they depend heavily on the psychological support of a human being (psychologism). Psychologism was an attempt to deconstruct the logical understanding of *konzept* and the closely connected one of *meaning*. The authors write:

On a polemic note, if you go along with the general drift of our analysis of 'Hesperus is Phosphorus', the answer to the direct reference theorist Jonathan Berg's rhetorically intended question, 'But does anybody ever explicitly mention notions?' [...] is straightforward: '*Everybody does it all the time!*' (p. 310)

The whole book can be conceived as an elaboration and development of an answer to this question. The general idea is the following: concepts are special *construction*, where constructions are the *genus proximum* for concepts. Roughly speaking, an expression of a language expresses a construction (procedure) whose product is an object of some type (or nothing). The authors' *expressis verbis* invoke Bolzano, Frege (his *Art des Gegebenseins*) and Church², as the forerunners of their theory; Pavel Tichý is indicated as the founder of the idea of constructions, and the book is dedicated to him. It is interesting enough that the three authors of the book belong to three different generations (in descending order: Materna, Duží, Jespersen). The general idea just mentioned is based on a *programme of general semantics*, which is expounded in the first

¹ The terms 'notion' and 'concept' have often been used interchangeably.

² Church's formulation: *The sense of an expression is a concept of the denotation.*

chapter. The programme is called *Transparent Intensional Logic (TIL)* and defined as “a logical theory with a view to logical analysis of sizeable fragments of primarily natural language” (p. 1), which is applied in the form of the *Logical Analysis of Natural Language (LANL)*.

The power of this analysis is amazing. The authors attempt to resolve almost all of the important problems and paradoxes of the philosophy of natural language. Some of the analyses can be taken as masterpieces of logical explanation. Logic in the book is understood as “unitary, universal logic”, which “would and should make a fine-grained analysis of relevant premises possible to create a platform for an ideal inference machine that neither over-infers (yielding consequences not entailed by the premises) nor under-infers (failing to yield consequences entailed by the premises)” (p. 34). The logic³ is not a logic in the standard sense of a formal logic (formal system), it is rather a language employing elements of type theory (simple and ramified), and lambda calculus, to speak about objects and constructions, the latter intended as extra-linguistic procedures (p. 35), and as “the most fine-grained hyperintensions available” (p. 41). Such hyperintensions are individuated in terms of procedural isomorphism. The objects as well as the constructions have their types, and constructions additionally construct their products (if any) which have their own types. Such an understanding of logic and its objects is both unconventional and non-standard. Because of this, *TIL* requires far more time for someone to have a basic grasp of it than formal theory usually does. From the theoretical point of view, the authors promise to follow what they call a top-down approach, i.e., “[*TIL*] generalises from the hardest case and obtains the less-hard cases by lifting various restrictions that apply only higher up” (p. 35). The more you put in, the more you get out. The second feature of *TIL*’s approach is anti-contextualism (transparency): “any given term or expression expresses the same construction as its sense in whatever sort of context the term or expression is embedded within” (p. 36). For instance, definite descriptions have the same meaning and denotation in direct and oblique contexts. And the third and most important feature is the functional character of the approach, which means that (partial) functions play the main role. *TIL* strictly differentiates between functions (functions-

³ In another place logic is characterised as a “science of correct reasoning and the art of argumentation”, and set in opposition to formal logic, which investigates the arguments “irrespective” of the meaning of premises and conclusion (p. 23).

in-extension) and constructions (functions-in-intension), the latter understood as “construction of a function” or a way in which a function is given. Such a construction or procedure can be assigned to an expression as its sense. A precise definition of construction may be found on page 45, where the atomic constructions are: *Variable*, *Trivialization*, and the complex constructions we get are *Composition*, *Closure*, *Execution* and *Double Execution*. *TIL* assumes the principle of compositionality “which comes down to explaining the semantic behaviour of compounds in terms of the semantic behaviour of their components” (p. 39). Constructions can be viewed as generalized algorithms, as Tichý writes:

The notion of construction is [...] correlative not with the notion of algorithm itself but what is known as a particular algorithmic *computation*, the sequence of steps prescribed by the algorithm when it is applied to a particular input. But not every construction is an algorithmic computation. An algorithmic computation is a sequence of *effective* steps, steps which consist in subjecting a manageable object [...] to a feasible operation. A construction, on the other hand, may involve steps which are not of this sort. (quoted from Duží *et al.*, p. 102)

Thus, *TIL*'s ontology is very rich. The authors make use of *Menger's Comb*, as opposed to *Occam's Razor*, where “the only way to add as few objects as possible in a non-arbitrary way is to add them all” (p. 103), and as a consequence they declare a ‘maximal ontology of abstracta’.

All the entities are divided into two main groups: functions and constructions. The constructions are algorithmically structured, abstract, extra-linguistic entities expressed by expressions. They have something in common with intuitionistic constructions, but in general they are different from them, especially because they are applicable not only in mathematics, but also in the analysis of natural language. All the functions and constructions are classified type-theoretically. The types of order 1 are built over an *objectual base*. The base the authors have chosen for the purposes of *LANL* is a collection of four pair-wise disjoint, non-empty sets, which are four atomic types: o – the type of truth-values $\{T, F\}$; ι – the type of individuals; ω – the type of possible worlds; and τ – the type of real numbers (discrete times), where their elements are taken as nullary functions. Over the base other types of order 1 are built; they are collections of partial mappings from m -tuples of types of order 1 into a type of order 1. Using the ramified type theory, all functions and constructions are classified into types and orders. In short,

from the formal point of view, *TIL* is hyperintensional, partial, typed lambda-calculus, for which the Principle of Extensionality and Leibniz's Law are valid. The nature of *TIL*'s entities is Platonic in essence, which could be very controversial for some philosophers, as the entities are extra-linguistic, non-mental, non-spatial, non-temporal. *TIL* acknowledges individual anti-essentialism, in the sense that individuals are *bare individuals*, which means that "no non-trivial intension is necessarily true of them" (p. 64). Possible worlds are taken in a *Tractarian* sense, as "maximal consistent sets of chronologies of possible state-of-affairs" (p. 61). The partiality of *TIL* results from the fact that we have two values T (true), F (false), and gaps, in cases where either a function lacks a value or a construction constructs nothing. The important tools of *TIL* are: *individual office* (a function of type $((\iota\tau)\omega)$), the distinction between *empirical* and *non-empirical* expressions, the former having an intension as a (*rigid*) *denotation*, and a *reference* which is the value of the denotation in the actual world at the present moment. An especially important role is played by the distinction between *de re* and *de dicto* supposition regarding either expressions or constructions (mentioning vs. using). This distinction is followed by the distinction of three kinds of context: hyperintensional (constructional), intensional (*de dicto*) and extensional (*de re*). The tools are introduced in the first two chapters and the rest of the book, consisting of three chapters, is an application of the ideas from the first two chapters.

The book is very carefully written, with the authors taking into account the average readers' often conventional attitude. There is no place, to the best of my knowledge, where the authors claim something without grounding it on firm premises. An example of this care would be where the authors, in the form of a dialogue, try to explain the essence of their approach (pp. 54–56). Thanks to their rich (and precise) ontology, the authors are able to draw useful distinctions and define many otherwise imprecise, yet very interesting notions. At the same time, some of their methodological assumptions lead to unintuitive results. For example, *TIL* presupposes, as an idealisation, full linguistic competence in language-users, understood in a rather extreme way. According to the authors it is part of the linguistic meaning of the word 'whale' that whales are mammals, the result being that the sentence 'Whales are mammals' comes out (surprisingly) as analytically true (p. 103). We thus have here a sentence involving the empirical expressions ('whale',

‘mammal’), which “expresses a construction constructing the proposition ‘*True*’ that takes value T” (p. 103) in all worlds and times.

The second chapter of the book is devoted to an elaboration of the general ideas of the first chapter. It begins with the exposition of the foundations of *LANL*, which are: the Parmenides principle, the principle of compositionality, and the ways in which analyses could be compared (worse and better analyses). Section 2.2 plays a central role in the book, for there we find the definition of *concept*. In very basic terms, what this amounts to is that “concepts are closed constructions” (p. 153). Thanks to this definition the authors are able to define: *simple concept* (this definition ought to have been by cases), *procedural isomorphism* of constructions; *empirical concept*, *strictly empty* (improper construction), *quasi-empty* (constructing an empty class), and *empirically empty concept* (constructing intension that either lacks a value at $\langle w, t \rangle$ or its value at $\langle w, t \rangle$ is the empty class). This rich and subtle ‘language of constructions’ allows one to discriminate between synonymous, equivalent and co-referential expressions. The term ‘existence’ is understood in a pre-Kantian way as a property of functions. The existence of bare individuals is simply taken for granted and treated as obvious. “To prove existence in mathematics is to prove that a concept is not strictly or quasi-empty” (p. 172). In the case of empirical concepts *existence* is the property of intensions of being instantiated. For instance, to prove the existence of the President of the Czech Republic is to show that the presidential office is occupied at the world/time pair $\langle w, t \rangle$ of evaluation. Thus the sentence ‘The President of the Czech Republic exists’ expresses a construction which constructs a proposition (type: $((\sigma\tau)\omega)$) taking the value T in the actual world at the present time (pp. 174–175). So *TIL* is in a position to exclude *possibilia* (possible objects) and impossible possible worlds (p. 178) from their ontology, their work being done by partial functions and more senses of the emptiness of concepts. The next distinctive feature of *TIL* is the rejection of actualism, as the semantic view that truth-bearers are evaluated at the actual world and at the present moment, and its replacement by explicit intensionalization and temporalization, “which does not privilege” a particular world or moment of time from the logical space (p. 178). Thus any empirical expression (atomic ones, too) should be analysed in an intensional context, i.e., with reference to possible worlds and times. The authors give a strong argument, based on “the omniscience objection”, according to which we cannot discern which world is the actual one on logical grounds.

The last three chapters, approximately 250 pages, deal with: singular reference and pragmatically incomplete meaning (ch. 3); requisites – the logic of intensions (ch. 4); attitudes and information (ch. 5); and present applications of the fundamentals of *TIL*. To give the reader a taste of the quality of the authors' analyses, I will quote some of the most typical matters (puzzles). The case of "Hesperus is Phosphorus" is a very well-known problem posited by Frege, which arguably still lacks a satisfactory solution. The most common solution is the *direct reference theory of names*, which is taken by the authors to be mistaken. Their solution is based on three tenets:

'Hesperus', 'Phosphorus' rigidly denote intensions (individual offices).
 'Hesperus = Phosphorus' expresses the contingent co-extensionality of two named intensions coinciding in one individual, not the necessary self-identity of an individual bearing two names. The contingency of the proposition that Hesperus is Phosphorus must be made explicit in the logical analysis of the sentence 'Hesperus = Phosphorus'. This is achieved by means of explicit intensionalization and temporalization (contingency). (p. 303)

In the *TIL* analysis we have two individual offices H and P , respectively. At a given pair $\langle w, t \rangle$ there are five possibilities regarding these offices: they have identical occupants, they have different occupants, the first one is occupied and the second one is not, the reverse case, and neither of them is occupied. It is a contingent matter which one of them obtains in the actual world at the present time, and it could be decided only after a posteriori empirical investigations. As a result of the analysis of the sentence 'Hesperus is Phosphorus' we get: $\lambda w \lambda t [{}^0 H_{wt} = {}^0 P_{wt}]$, where H_{wt} is the individual which occupies the office H at the world w and time t , and the trivialization ${}^0 H$ is the sense of *Hesperus* (the same, respectively, for P). The product of this construction is a proposition whose truth-value can be determined only by empirical research at the given world and time. A second example is the problem where the authors save the validity of the inference that Jumbo is small, from the premise that Jumbo is a small elephant (p. 395), although this inference is treated as a puzzle (non-valid) of formal logic. The authors introduce a new inference rule called *pseudo-detachment*, which validates the Jumbo and similar cases. The rule allows us to replace the property modifier *small* occurring in the premise with the property *small**, which can be predicated of Jumbo.

For other inferences the original notion of a *requisite* relation is put to use, which is derived from the *intensional essentialism* presented in the book.

That an intension has an essence means that a relation-in-extension obtains a priori between an intension and other intensions such that, necessarily, whenever an individual exemplifies the intension at some $\langle w, t \rangle$ the same individual exemplifies certain other intensions at the same $\langle w, t \rangle$. (p. 359)

One of the most interesting and attractive features of *TIL* is the retention of many natural tools in the analysis of natural language. One of them is the extensional character of the underlying logic and interpretation of (*hyper-*)*intensional attitudes* (treated as non-extensional) in it. This was done through considering for example ‘*a* believes that *p*’ not as a relation between an agent *a* and a proposition *p*, but between an agent and a procedure (construction, concept) producing the proposition *p*. Generally, an agent’s attitudes can be directed toward either a hyperintension or an intension. Thanks to this and the interplay between *de dicto/de re* the authors distinguish between four kinds of attitudes: intensional *de dicto/de re* and hyperintensional *de dicto/de re*. Applying these distinctions, the authors propose a solution to the so-called *Mates puzzle*: after its formulation in terms of *TIL* (using anti-sententialism and their definition of synonymous expressions, as expressing the same construction), it turns out not to be a puzzle at all.

Now is the time to give some critical remarks regarding the content of the book. *TIL* aims to present the theoretical basis for *LANL*. The book is full of examples of *LANL* as applied to a variety of issues. However, there is the question of whether every problem in the field of natural language can be analysed using the tools of *TIL*. Nowhere in the book do we find the explicit claim that every problem in the field of natural language is solvable by *TIL*. Nevertheless, we would expect at least an adequate analysis of all the linguistic phenomena that the authors explicitly discuss. The sentence connectives that belong to natural language may serve as an example of such an issue. In the section entitled ‘Logical objects’ (pp. 84–94) the authors do not consider the issue of connectives, but the different, though related, question of truth-functions that are extensions: a certain type of objects identified by constructions, which correspond to expressions that are sentence connectives. Truth-functions as extensions — being neither intensions (according to *TIL*),

nor constructions — are logical objects. However, this is not the case for the denotations of all propositional connectives of natural language. It seems that the authors assume a one-to-one correspondence between all propositional connectives and truth-functions, which is a very controversial and widely criticised idea.

The book contains minor inconsistencies and substantive inaccuracies. For example, according to the authors (p. 280), Bertrand Russell had argued that the ι -operator has neither meaning nor denotation. Such a presentation of the views of Russell seems to be a simplification, as he claimed in “On Denoting” that the ι -operator indeed does not have sense, but there are places on the basis of which it can be assumed that Russell allowed it to have a denotation (see e.g. [5, p. 126]).

Furthermore, the authors classify, without justification, Donnellan’s famous distinction between the attributive and the referential understanding of definite descriptions as belonging to pragmatics (p. 281), while in the literature there is a dispute about the nature of this distinction, and some (such as Devitt) opt for its semantic character.

Additionally, one would expect a serious philosophy of language to propose a solution to the established problems of proper names. One of them is the relationship that occurs between names and definite descriptions. Definite descriptions are well described by the authors as denoting individual offices, but there is also the question of proper names outside of mathematics; the authors carefully distinguish the language of mathematics from the language in which empirical concepts appear. Proper names are not ordinary labels (p. 285) as, due to the assumption of compositionality, every proper name must make a constructional contribution to the structure corresponding to any sentence containing such a name. Also due to the general requirements of procedural semantics, each term has to have a corresponding construction as its meaning. A separate section (3.2) of the book is dedicated to the issue of proper names. The authors suggest two possible constructions corresponding to proper names: trivialisations or variables. For example, the proper name ‘Charles’ corresponds to the trivialisation ${}^0\text{Charles}$ and the analysis of the sentence ‘Charles is happy’ results in $\lambda w \lambda t [{}^0\text{Happy}_{wt} {}^0\text{Charles}]$; or the name corresponds to a variable and then we have $\lambda w \lambda t [{}^0\text{Happy}_{wt} x]$. The difference is that the first construction is a concept while the second is not. The latter understanding is supported by the empirical fact that we often have to deal with names and at the same time we do not have enough information about the identity of the individual. Ul-

timately, however, the authors recognise trivializations as the sense of proper names. Yet, if we assume the existence of a perfectly competent user of language, then, according to the authors, he or she knows that Tully is Cicero. The strange thing in this case is that the solution to the ‘Cicero’-‘Tully’ problem is different from the solution to Mates’s (non-)puzzle in Section 5.1.1. Their stance on proper names is thus imprecise and, one might say, contextual. Additionally, this fully competent, idealised language user, as an assumption, or even a derivative of assumptions, of procedural semantics, causes some confusion in the case of fictional names. Their senses are considered as variables running over individuals, although fictional names themselves only appear to be proper names. The difference between such an understanding of fictional names, and a similar one with regard to proper names is that the structure is not closed. It allows us to “identify Sherlock Holmes with any particular individual (e.g. with the author or reader himself or herself) or no-one in particular.” (p. 287) This raises a problem such that if the “semantics of ‘Sherlock Holmes’ is that it expresses a free variable ranging over individuals as its sense, but fails to denote [...]” and “ ‘Sherlock Holmes is happy [at the moment (AO.)]’ has a meaning, but [...] lacks [...] a truth-value”, then the same is with the sentence ‘Moriarty is happy [at the same moment (AO.)]’. However, discourse about fictional characters, even though their names have no denotation, seems to have a certain internal logic of narration and makes some assertions concerning fictional (not real) ‘facts’. For example, some sentences from Conan Doyle’s books seem to be equivalent, e.g. ‘Moriarty is not happy’ \equiv ‘Holmes is happy’. What is more, in Section 4.3 (pp. 385ff) the authors deal with Saul’s puzzle which questions the substitutability of co-denoting terms in extensional contexts (‘Superman’ vs. ‘Clark Kent’). They manage to solve these puzzles thanks to certain clever distinctions that can be drawn within procedural semantics. However, in my opinion, an inconsistency can be noted, since Clark Kent, Superman, and Sherlock Holmes are fictional characters. However, Duží *et.al.*’s discussion of ‘Superman’ vs. ‘Clark Kent’ relies on the standard assumption (which also Saul makes) that these two names denote real people rather than fictional characters.

The treatment and understanding of the issues related to fictional names differ substantially in Section 4.3 from what is found in Section 3.2: individual roles are assigned to the first character, and a variable to the last one. The analysis of the sentence ‘Holmes is happy’

$(\lambda w \lambda t [{}^0 \textit{Happy}_{wt} x])$; p. 287) will differ substantially from the analysis of ‘Clark Kent is happy’, which probably will have the following result: $\lambda w \lambda t [{}^0 \textit{Happy}_{wt} {}^0 \textit{Clark_Kent}_{wt}]$ (4.3). One can also have doubts about the analysis of expressions like ‘The Morning Star’ (this expression denoting an individual office) and ‘the morning star’ (also denoting an individual office); and how to distinguish one from the other. The authors do not address the issue of so-called descriptive names, as they reduce these expressions (without justification) to definite descriptions. The main problem for descriptive names is whether they designate rigidly, because, by definition, they are names whose referent is determined by the description. Tichý’s modal argument, which is quoted on p. 304, indirectly related to this case, essentially contains a *petitio principia*, because it presupposes that these names do not denote rigidly.

Section 3.4.2. concerns indefinite — understood as ‘incomplete’ — descriptions and attempts to solve the problems associated with them, chief among which is the problem of determining the logical value of sentences containing such descriptions. The authors refer to the views of Neale, but the essence of their solution resembles that of Wettstein [6]⁴. However, Peacock’s [4] arguments from 1975 already demonstrated the inadequacy of this approach, in particular in terms of incomplete attributive descriptions; these issues are not considered from the perspective of *TIL*.

Another issue is the so-called top-down approach, repeatedly mentioned in the book, particularly in the first chapter. It is based on the strategy of creating tools and approaching the problems that are the most complicated and complex ones, and then moving to the simpler cases. The authors mention this, claiming that they can solve the hardest case(s) (p. 289): “[...] our general top-down strategy is to develop for the hardest (or a very hard) case [...]”. However, when they demonstrate methods of dealing with some of the problems, it seems that the hardest cases are omitted. In this context one may ask whether and how the authors would cope with the so-called *paycheck sentences* (“The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress” [3]), *donkey sentences* with the majority quantifier (“Most men who own a donkey beat it” [2]) or the Bach-Peters sentences (“Every pilot who shot at it hit the MiG that chased him” [1]). All are testing constructions for a theory of anaphora, but the solutions they propose

⁴ Wettstein’s papers are not mentioned in the bibliography.



as an analysis of anaphora in Section 3.5 do not seem to extend to such cases.

To sum up, the book is highly sophisticated and should be read by those with a grasp of the fundamentals of logic, (ramified) type theory, the lambda-calculus, and most of philosophy of language. Even someone who knows classical set theory but has no knowledge of (ramified) type theory or the lambda calculus, would be somewhat helpless. My general opinion of the book is very positive and I encourage others to read it, although it is not exactly an easy task.

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