Introduction to Pavel Tichý's Philosophy and Logic

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Pavel Tichý was an analytical philosopher and logician. The main part of his work is devoted to the development and applications of his *transparent intensional logic* (*TIL*) which is essentially based on typed λ-calculus. Tichý was born in Brno (2/18/1936, in the Czech Republic, formerly Czechoslovakia). He studied mathematics and philosophy at Charles University in Prague, where he taught during the 1960s. In 1971, he received his second PhD in Exeter (England). All received degrees were for works in logic, the respective texts were published. After the occupation of Czechoslovakia by the Soviet Army in 1968 he decided to emigrate, thus he accepted a proposal to become a logician at the Philosophy Department of Philosophy at the University of Otago (Dunedin, New Zealand). He was the first New Zealand philosopher who received his own professor chair (1981). In 1994, he was elected to become a head of Charles University Logic Department; but due to his sudden death (10/26/1994, Dunedin) he did not attend at the position. His only published book is *The Foundation of Frege's Logic* (*FFL*).[1] The second source for readings is the book of his *Collected Papers*[2] in which there are reprinted 46 of his 48 published papers (four of them written with Graham Oddie, one with his wife Jindra). Most of the papers were published in the leading philosophical or logical journals.

The main motive of Tichý's philosophy and logic may be found in an explication of various philosophical phenomena relying on the usefulness of the knowledge yielded by natural sciences. The introduction of FFL ends by: "I will argue that the 'hierarchy of entities' [his ramified hierarchy of types; J.R.] is ... the right medium for modelling our whole conceptual scheme.". It seems thus that Tichý subscribed to the proposal *to explicate (model) the whole conceptual scheme*.

To understand the various topics Tichý himself addressed consider the following scheme (often repeated by Tichý) of a subject inquiring reality. When confronted with the external world, a cognizant subject S realizes facts that hold. The external world is construed as a collection of basic objects, individuals, over which there are distributed various attributes (properties and relations) in some way. S manages a pre-theoretically given intensional basis which is a collection of attributes corresponding to (primitive)

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[1] Berlin-New York: Walter de Gruyter; 1988.
[2] *Pavel Tichý's Collected Papers in Logic and Philosophy*. Svoboda, V., Jespersen, B., Cheyne, C. (eds.), Dunedin: Otago UP, Praha: Filosofia; 2004.

predicates of L (a language of S). L enables S to record her findings or hypotheses about the obtaining facts. Extensional framework explicates a fact as a belonging of an individual I_k to a certain class C; such explication is inadequate for empirical facts obtain contingently, whereas class membership is a necessary matter. An *intensional framework of empirical inquiry* (this is not Tichý's term) rather accepts that there are many different distributions of the same attributes over the same individuals. These distributions are called possible worlds (only one of them happens to be the actual one). Facts or attributes are then explained as functions from possible worlds, i.e. as being modally conditioned.

Explication of natural language – which is construed as a vehicle enabling us to discuss facts – stems its material adequacy from the correspondence to the just given picture. The sentence by means of which S records the fact that I_k is 2 meters tall is understood by another subject (using L) when she captures the concepts of I_k and of the property that are combined into a certain structured procedure. To verify the sentence amounts to execute that procedure empirically, i.e. to perform a test on I_k's being 2 meters tall.

Tichý's first model of what a sentence means was algorithmical-procedural: Intension in Terms of Turing Machines (1969; the paper was delivered at a conference in Amsterdam already in 1967). In the end of the 1960s Tichý met Montague's adaptation of Church's simple theory of types (typed λ-calculus), i.e. Montague's intensional logic. He immediately published his own version in An Approach to Intensional Analysis (1971). Tichý's early logic surpasses that of Montague in various features. Tichý added to Church's basic types (individuals, truth-values) a collection of possible worlds, ω. Any *intension* – i.e. a function from possible worlds – is explicitly represented by λ-abstraction with binding of a possible world variable (λ*w*[...*w*...]). Tichý convincingly showed (also in Two Kinds of Intensional Logic, 1978) that his logic does obey the extensionality principle, but Montague's logic does not. The step to the value of an intension is clearly represented by an application to the possible world variable. This 'intensional descent' enables to avoid Montague's contextualism. According to Tichý, an empirical expression is always about an intension (What Do We Talk About?, 1975). The difference between so called transparent (direct) and oblique (indirect) contexts is based on the intensional descent figuring prominently in the former case.

In 1973, Tichý finished a long paper On Describing[3] showing a capability to clarify many puzzles discussed within contemporary philosophy of language by means of his logic.

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[3] *Organon F* 14, 4, 423-469; 2007.

In 1976, Tichý completed an extensive book *Introduction to Intensional Logic* (*IIL*) which remains unpublished. In the second half of the 1970s he published several topics treated already in IIL. This second stage of his TIL (now explicitly called by this name) allows partial functions and it contains its own system of deduction. The most interesting philosophical concept from it is that of an *office* (or a *role*). It is discussed extensively in the introduction to ILL which was published separately in 1987 (Particulars and Their Roles). An individual office is something an individual can be (can occupy). For instance, "the U.S. president" is an office occupiable by particular individuals. "Pegasus" is also an office, but in the actual world there is no individual who fulfils the conditions, requisites, prescribed by the office, namely being the only individual which is winged and is a horse. Individual offices are explicated as intensions having individuals as values. Frege's Sinn, Meinong's pure object, Carnap's individual-in-intension, and Church's individual concept are, of course, predecessors of an individual office. Nevertheless, Tichý's conception is quite general: properties are offices occupiable by classes of individuals, propositions are offices occupiable by truth-values, etc.; there are also offices occupiable by offices of a lower degree. Tichý noticed that individuals and offices are often confused. For example, properties ascribable to offices are mistakenly construed as properties of objects (possibly filling those offices). A typical individual property is 'external' to an individual but offices are related to two kinds of properties. They can possess certain 'external' properties ("being a favourite office"); nonetheless, various sentences are about properties 'internal' to offices (e.g., being an U.S. citizen is a requisite of the office "the U.S. president").

The notion of intensional descent yields Tichý's quite general theory of *de dicto* / *de re* which concerns with all kinds of expressions (De Dicto and De Re, 1978). An expression is in the supposition *de dicto* in a sentence (or other expression) when what it says (*dictum*) is all sufficient for the verification of the sentence; but it is in the supposition *de re* when its reference to a *res* unspecified by it comes into play as well. The description 'the U.S. president' is not about any particular individual but about an individual office. An individual office cannot reasonably possess the property "bald"; thus it is obvious that the sentence 'The U.S. president is bald' is about an individual office and a property of individuals, however, the property is ascribed to whoever (certain *res*) is singled out by the description 'the U.S. president', i.e. to the holder of that office (the value of the intension) in a particular world (the case of intensional descent); the description occurs in that sentence in a *de re* way. On the other hand, the description occurs apparently in the supposition *de*

dicto in the sentence such as 'The U.S. president is an interesting political post' because it is the office itself which is attributed to be such and such, not its contingent holder. An expression not denoting an intension (e.g., a proper name) occurs always in the supposition *de dicto*. An addendum: the object of the *notional attitude* of Ponce de Leon's seeking the Fountain of Youth is clearly an office, not an individual (one cannot thus apply a *de re* version of existential generalization in order to derive that there is an individual who is – fills the office of – the Fountain of Youth); so called *de dicto beliefs* are construed as attitudes towards a proposition, as it is usual.[4]

Tichý defended the idea that the *existence* property ascribable to individuals is a trivial one. A trivial property (the term borrowed from Plantinga) has a constant range of values across the logical space. Examples: "being self identical", "being identical with I_k". Every object possesses (necessarily) sundry trivial properties. On the other hand, a non-trivial property has a varying range of extensions. Examples: "being a whale", "being an interesting political post" (which is a property of individual offices), etc. According to Tichý, common ascriptions of existence concern offices. To say that the U.S. president exists does not amounts saying the triviality that a certain particular individual enjoys to be in the universe of discourse, i.e. existing. It says rather a non-trivial empirical fact that the office in question is occupied. In Plantinga on Essence: A Few Questions (1972) Tichý introduced his 'thought experiment' to test existence. To ascertain whether an individual I_k happens to instantiate some non-trivial property ("having 10.000 hairs") one has to get I_k and perform a test which can come out true or false. However, to implement an analogous test on its existence is absurd: getting I_k, such test comes out trivially (tautologically) true; otherwise, it is simply false. Tichý thus also denies the idea of varying domains. When saying that there is an individual who does not exist, the proponent of this claim does not bring our attention to any particular individual – she talks rather about an office which is unoccupied in the actual world. In Existence and God (1971), Tichý examined the ontological proof. Due to his reconstruction, God is not an individual but rather an individual office which may occupy the office of offices "that than which a greater cannot be conceived". Tichý doubted Anselm's premise that the necessary existence, a requisite of that office of offices, is a good property of individual offices (for necessarily occupied offices – in an inconvenient possible world filled by, e.g., malevolent, individuals – are hardly noteworthy).

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[4] One frequently mentioned application of his logic concerns with the logic of questions, Questions, Answers, and Logic (1978); a question denotes an office and the (actually) best answer to it denotes its actual holder.

The sketched intensional framework should be defended also with respect to other metaphysical concepts. Tichý argued heavily *against individual essentialism* of Plantinga or Kripke (Kripke on Necessity A Posteriori, 1983; there he dismissed also the idea of coextensivity of concepts of synthetic and *a priori*). According to Tichý, no individual possesses whichever nontrivial property in virtue of necessity. An individual T cannot be known primarily by its being wooden, because otherwise the testing of T for woodenness would be quite idle. A subject has to know the identity of T before any empirical test; S knows T simply by knowing that it is just T. Tichý entered the idea that *individuals* are *bare* also in other his texts. Note carefully that being bare is not meant in the sense of lacking nontrivial properties. An individual is bare iff for any nontrivial property P it instantiates, there is a possible world in which it lacks P (and for any trivial property, it cannot lack it).

In 1979, Tichý accepted a *temporal parameter*; for a possession of an attribute depends, no doubt, also on time. Thus an intension is a function from possible worlds to chronologies of objects (or simply: a function from possible worlds and time-moments). His paper The Transiency of Truth (1980) rejecting the atemporal predication (Frege, Russell and others), which leads also to McTaggart's paradox, was reprinted several times. Handling the temporal factor enabled Tichý to propose his most brilliant logical analyses of natural language expressions, namely semantical analyses of verb times and frequency adverbs (The Logic of Temporal Discourse, 1980) and episodic verbs (The Semantics of Episodic Verbs, 1980). Tichý and Oddie suggested comprehensive analyses of concepts of *ability*, *responsibility* and *freedom* (The Logic of Ability, Freedom, and Responsibility, 1982; Ability and Freedom, 1983). There, possible worlds are characterized also by *nexuses* among *events*. The ability of an agent depends on up-to-now history of her actions that have been influencing the state of a world and thus also its possible continuation.

Tichý's conception of *possible worlds* is a combinatorical one. Pre-theoretically given primary (single) attributes (including nexuses) give rise to so-called determination systems (FFL).[5] Not all of them, however, are pre-theoretically possible worlds; e.g., a determination system assigning to one attribute overlapping classes is not realizable, it is not a possible world. But members of type ω, i.e. possible worlds within the system of explication, are to be construed as primitive, nonanalyzable entities – only representing pre-theoretically given possible worlds – in order to avoid a circle in explication when possible worlds are

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[5] So-called derivative attributes (e.g. "being red and being south from I_k") 'supervene' on primary attributes; derivative attributes do not generate determination systems. Btw. Tichý and Oddie defended the distinction between the weak and the strong supervenience of properties in Resplicing Properties in the Supervenience Base (1990).

explicated as classes of propositions and propositions are explicated as classes of worlds. On the other hand, pre-theoretically given possible worlds can be 'reconstructed' within the system of explication and we can get then propositions which may be considered as facts. Tichý's conception is not a pure actualism or a pure possibilism, since he accepted fixed (maximal) domain of individuals and distinguished individuals from individual offices ('possible individuals').

The most known Tichý's contribution is his attack (1974) on Popper's early definition of *verisimilitude*, i.e. likeness of theories to the truth (the actual world), and his prompt suggestion of a new exact definition of verisimilitude counting in Verisimilitude Redefined (1976) and Verisimilitude Revisited (1978).[6] Tichý analyzed also *subjunctive conditionals* (already in IIL), i.e. claims like 'If A obtains, then B obtains' that are frequently used in sciences. In his third paper on them (Subjunctive Conditionals: Two Parameters vs. Three, 1984) he defends the idea that there is a third – tacitly understood – parameter affecting their truth-conditions.

Since findings of subjects are used for inferences of other knowledge, it is desirable to propose a suitable system of deduction. Tichý's *system of deduction* within a simple theory of types – handling also partial functions – was an integral part of IIL. However, he published a compressed version as late in 1986 in the study Foundations of Partial Type Theory. Its development concentrated of identity claims occurred in Indiscernibility of Identicals (1986). As defended in FFL, Tichý preferred a two-dimensional conception of inference (Frege and others).

In the mid-1970s Tichý began to distinguish an entity standing between a λ-term and an object the λ-term represents; he called it *construction*. A construction may be viewed as an objectual counterpart of λ-term (or as a so-called 'intensional' representation of an 'extensional' object). Construction is an abstract (usually structured) non-set-theoretical procedure constructing (typically) a set-theoretical object. For instance, the number 7 can be constructed by various different (but equivalent) constructions expressed by '[√ 49]', '[+ 3 4]', etc. For another example, consider the only proposition which has the value true in all possible worlds and times; it would be odd to insist that mathematics and logic is about this one simple object. Logical and mathematical theorems are rather different constructions constructing that single proposition. Thus *logic and mathematics are about constructions* (FFL;

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[6] Graham Oddie extended Tichý's work in various articles and published also a book on it (1986: *Likeness to Truth.* Dordrecht: Reidel.)

Constructions as the Subject Matter of Mathematics, 1995).[7] This claim was concluded by Tichý in the mid-1980s and he diagnosed that the failure to distinguish between functions and their constructions is the source of a widespread logical and philosophical double-talk. E.g., propositions are spoken as negative but surely no proposition contains negation or anything 'negative' – only our expressions and constructions expressed by them contains negation; analogous holds for properties. In Constructions (1986) Tichý found that the same mistake affected the heart of Frege's system, since Frege retained the terminology apt for the old notion of functions (i.e. constructions) for his describing of functions as mere correspondences between arguments and values. Frege's logic, as well as that of Church or Russell, is thoroughly examined in FFL.

There, Tichý also exposed his most sophisticated version of TIL which uses a specific ramified hierarchy of types. The modes of constructions expand to six kinds, mentioning here only four: trivializations (objectual counterparts of constants), variables (objectual counterparts of variable letters), compositions ('applications'), closures ('λ-abstractions'). The trivializations (^0X takes X and leaves it as it is) are really needed for the possibility to be able to discuss a construction as such. E.g., when saying that $[^0\div\ ^03\ ^02]$ is my favourite calculation, I am talking about $[^0\div\ ^03\ ^02]$, not about the number constructed by $[^0\div\ ^03\ ^02]$; in the analysis it occurs the construction $^0[^0\div\ ^03\ ^02]$ which constructs just $[^0\div\ ^03\ ^02]$.[8] Tichý also suggested that *expressions are about constructions* they express. Another refinement concerns with *propositional attitudes* which are understood as attitudes towards constructions of propositions.[9]

As soon as constructions of constructions are allowed, it is quite natural to expose *the ramified theory of types.* For no construction may construct itself. For instance, the range of c^1 has to be the collection of constructions among which there is not c^1 itself. Hence, the first-order constructions belong to the type $*_1$ and they can be constructed by some second-order constructions (such as c^1) belonging to $*_2$; and so on up. Moreover, mappings from various types to (or from) *n*-order constructions are classified by Tichý's ramified theory of types too. In FFL, Tichý examined also the *Liar paradox.* The key revelation is that the *truth*

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[7] In the last mentioned text Tichý also suggested that the only genuine complexes are constructions because they are the only objects having only unique decomposition.
[8] Some preliminary ideas about trivialization occurred in Frege and the Case of Missing Sense (1986) which is adopted in FFL.
[9] Among papers following FFL they are *Sinn & Bedeutung* Revisited (1992), The *Tractatus* in the Light of Intensional Logic (1994), The Myth of Non-Rigid Designators (1994). However, they can be viewed rather as polemics with ideas often attributed to – but sometimes not explicitly held by – Frege, Wittgenstein and Kripke.

of expressions is essentially language-related. An expression E is true in a language L when it the construction C expressed by E in L is true; C is true when it constructs a proposition having the truth-value True as its value (in a given world, time). He suggested construing of a language as a code, i.e. as a mapping from (Gödelized) expressions to constructions of a given order. It is clear enough that a construction $^0K^1$ constructing certain 1-order code cannot be among values of K^1; $^0K^1$ is a 2-order construction. Thus the disambiguated version of a liar sentence, namely 'This sentence is not true in K^1' cannot be true in K^1; due to compositionality, it is in fact meaningless in K^1 (but it has a certain meaning in K^2).

When Tichý completed FFL, he started a very ambitious project he called *Meaning-Driven Grammar*. In the sample study Cracking the Natural Language Code (1994) he explains that semantical analysis of natural language should discover grammatical rules generating movements from various expression-meaning pairs to another expression-meaning pairs.[10] The example he gives shows richness and complexity of such grammatical rules. Unfortunately, the prepared book remained unfinished (its first chapter, and the list of chapters, was published as The Analysis of Natural Language (1994)).

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[10] In The Scandal of Linguistics (1992) and in the next mentioned paper he argued that Montagueans and Chomskyans do not go this direction.