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LEIBNIZ'S *LINGUA CHARACTERISTICA* AND ITS CONTEMPORARY COUNTERPARTS

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There is no need to introduce Gottfried Wilhelm Leibniz, a great philosopher, theologian, diplomat, creator (independently of Isaac Newton) of the infinitesimal calculus and founder of the Academy of Sciences in Berlin. He also planned the development of the so-called *Lingua characteristica* (the plan shared by other 17^{th} century scholars). Literally taken, the name of the language means a *language of letters*, a *graphic language*, also called a *characteristica universalis*. It was meant to be a way of expressing meanings, as modeled after methods used in arithmetic and geometry (Leibniz also mentions logicians) and having unusual properties.

1. Like mathematical methods, such as written multiplication, *lingua characteristica* is supposed to enable an assessment of the reasoning correctness on the basis of the notation alone, which would prevent disputes between followers of opposing ideas and thus eliminate such disputes at the outset. Agreement would be reached by means of performing calculations in public, as encouraged by the Latin motto: *calculemus* (Murawski 1994: 93, 97).

2. *Lingua characteristica* will shut the mouths of ignoramuses as in the new language it will be possible to write about and discuss those topics only that one understands; otherwise the mistake will be noticeable for everyone, the author included (Murawski 1994: 95). (The text fails to mention authors of utopian designs, but these have not yet been expressed in a magical language).

3. The language would be extremely easy to learn, offering symbols for human thoughts as the so-called *lingua mentalis*. It will also serve communication between nations, which would accept it as a very useful device. One can guess that there is just ONE *characteristica universalis*; otherwise the dispute between followers of the various options seems inevitable.[1]

Thanks to this wonderful language, anything cognizable would be cognized or, to be more precise, executable or calculable *ex datis* — on the basis of the data one has. If the method, applied by mathematicians did not suffice to discover everything one would have expected, it did at least prevent them from error — "if they did not say everything they should have, then they also did not say anything they should not have" (Murawski 1994: 94, 92).

From the standpoint of Leibniz's monadology, each monad (simple substances) contains all its future history (Murawski 1991: 47-48, 51-52), as some kind of DNA. In parallel to substances, a notion pertinent to it, too, has to contain in its contents all the predicatives that can be truthfully predicated of that substance. The path to truth, according to Leibniz, is an analysis of notions, which occurs through the application of mathematical operations (from the domain of combinatorics) on simple notions (Batóg 1991: 109, Murawski 1994: 91). The great mathematician was in favor of numbering notions (Audi 1996: 429), as numbers reflect their essences.[2] The analysis of language which he carried out usually does not go beyond the analysis of names, omitting e.g. predicatives with a bigger number of arguments or functional symbols, such as the signs + and =.[3]

The totality of notions is a network that starts with simple notions and then includes more and more complex ones, with the ordering relationship for the system being that the relationship of some notions is contained in others

[1] See Audi 1996: 427-429. The great thinker's "ecumenical" desires about the unity of Christians ought to be mentioned, as well as his contacts with Baruch Spinoza. Cf. Audi 1996: 759, Murawski 1994: 91, 97, Marciszewki 1988: 92.

[2] "Essentiae rerum sunt sicut numeri." See the paper by Witold Marciszewski, discussing the same (1999), "Być robotem — sposób na nieśmiertelność" (http://www.calculemus.org/lect/si/b.html) [being a robot is a way to achieve immortality].

[3] "It needs to be borne in mind that Leibniz was strongly influenced by Aristotle and the scholastics, and usually limited himself to deliberating on those notions only that were expressible by names and forgot to mention the notions (familiar to him, incidentally) that corresponded to functional symbols, predicates with two or tree arguments, etc." (Batóg 1991: 109).

(like the Aristotelian categories, where from the highest classes — categories — we move down to the narrowest, along the pattern: kind (that which is superior)/species (that which is subordinate/ species difference (that which differentiates one species within the kind from another species)). KIND and SPECIES are names of relationships, and any being — the extremities of hierarchies included — is at the same time a KIND for a subordinate SPECIES and a SPECIES for a higher KIND.

Leibniz went on to abandon the idea that an analysis of notions can be conducted to the level of original notions in an absolute sense, but he continued to believe that the level of the simplest notions man uses can be attained. It was the application of an appropriate system of signs (Burkhardt 1980: 219-220, 197) that was supposed to be of assistance in conducting relevant analyses, or even their indispensable condition.

The contemporary counterparts of Leibniz's idea that seek to attain similar OBJECTIVES concerning communication and consensus between people (other than Ludwik Zamenhoff's Esperanto) include Anna Wierzbicka's *Lingua Mentalis*, under construction for years now, as well as the *Ehmay Ghee Chah* universal foreign language by Elmer Hankes. As Zenon Klemensiewicz wrote in 1963, there had already been several hundred such attempts before (Klemensiewicz 1963: 9).

On the other hand, one needs to mention formalism, which was prevalent in the 1920s logic, and which used METHODS that were similar to those that Leibniz proposed in the construction of *lingua characteristica*.

1. LINGUISTIC DESIGNS

Esperanto is probably the best known contemporary attempt of the kind, and possibly the most consistently realised. Started by the Warsaw ophthalmologist, Dr Ludwik Łazarz Zamenhoff (1859-1917), it must have been intended as "giving hope" since the very word "Esperanto"szyk> means in that language 'a hopeful.' The first textbooks of the new language, published in Russian and Polish, were signed by the author's nickname, who would call himself "Dr Esperanto."[4]

Białystok, where he was born, was in those days a multilingual town (as the whole of Poland was[5]), and a Jewish town in particular, just as Zamenhoff's family were Jewish. Languages divided people, which fortunately

[4]See http://esperanto.pl.

[5]The illusion of Poland as a country speaking homogeneous Polish is shattered by the interesting and well-researched booklet by Marian Kucała (2002).

was not always a problem. Władysław Bartoszewski offers some interesting recollection on this subject in his book-length interview, given to Michał Komar. As a child, he learned to understand Yiddish and following his return from the park asked his mom why he was a 'stupid goy,' as he heard a Jewish mother forbid her child to play with him using this particular phrase. Fortunately, little Włodzio's mother did not seem to care very much (Bartoszewski, Komar 2006: 9).

That language borders are not always treated lightly by children and adults is known to us from the painful history of the 20^{th} century (if not from the contemporary experience). The deadly danger of not being able to pronounce the word *shibboleth* is known to us from the early parts of the Old Testament.[6]

The historical and geographical coincidences might probably be credited for Zamenhoff's success (he was a son of a foreign language teacher) in creating a language that would be user friendly and allow the overcoming of existing barriers without creating new ones. Alas, despite grammatical simplicity, Esperanto does treat people unequally because of its heavy reliance on Romance grammars (Latin, Italian, French, Portugese), and not everyone — not even before World War II — could use those.

Postwar designs include the *Lingua Mentalis*. Within its framework, Anna Wierzbicka indicated the co-called 'semantic primitives,' to which any expression of the natural language can be reduced. Initially there were 13 of those: *I, you, someone, something, world, this, want, not want, think of, say, imagine, be part of, become*.[7] This number grew in her subsequent publications, reaching about 30 elements in 1991 and 60 in 2002. These so-called universals are supposed to facilitate the expression of all meanings that someone who uses any language wishes to express. The examples presented in print usually concern two languages: English or Polish but, in the opinion of Wierzbicka, English can be replaced with any natural language. Elsewhere she states that some more complex schemes "are more associated with a specific language, such as *I want to do this*."[8]

Specific examples of the application of the method presented are not

[6]The Book of Judges 12:6. This is to thank Janusz Wojnar for his assistance in positioning this O.T. passage. C*f.* the paper by Jerzy Bartmiński (2000) concerning national identity:

http://www.wtk.poznan,.pl/Archiwum/20001019/Bartminski.html

[7]Wierzbicka 1980: 10; my punctuation — AP. Initially these words were printed in columns.

[8]See Wierzbicka 1988: 9, 10 and 1991: 7, 8. *Ibidem* see the differing lists of 'supplementary terms.'

always in full agreement with the declarations concerning the vocabulary used, since alongside the so-called semantic primitives, they also include notions that are "relatively very simple and extensively recurrent in the world's languages as separate lexical units." The examples of analyses concern at least three levels of semantic encoding: lexical items, grammatical and illocutionary means.

Because the lexical analyses are very extensive, let us present one example only. What is a cup? This is just a fragment of the answer:

CUPS
A KIND OF THING THAT PEOPLE MAKE
IMAGINING THINGS OF THIS KIND PEOPLE WOULD SAY
THESE THINGS ABOUT THEM:
PURPOSE
These are made for people to use repeatedly for drinking hot liquids from, such as tea or coffee,
one person from one thing of this kind
Being able to put them down on something else
MATERIAL [...]
APPEARANCE [...]
WHAT PEOPLE MIGHT SAY ABOUT THEM [...]

As can be seen, the analysis uses complex sentences. With not a word of comment a (relatively) correct word order of some specific language is used and, in the case of Polish, suffixes are correctly selected. In the analyses of English examples, there tend to be correct forms of irregular verbs, and complex sentences make extensive use of gerunds (one drinks from cups *when sitting at a table*) whereas cup plates are made *for putting them* [i.e. cups] *on*. Articles and prepositions are applied with no comment, although anyone trying to apply those on one's own knows how treacherous this is.

The analysis of grammatical structures yields much shorter examples. This is the first of those:

Hilary made Robin type the letters; ['the' was not mentioned among the universals even though the list includes the phrase 'the same'].

Hilary wanted this: Robin will type the letters
Hilary did something because of that
Robin typed the letters because of that
not because Robin wanted it
Robin didn't want it (Wierzbicka 1988: 241)

In 1974 James McCawley (1974: 30) presented a syntactic analysis of a sentence that included the predicate 'persuade,' which was in itself

analyzed in a way typical for generative semantics. The analysis of the inner syntax of the lexeme 'persuade' contained — in appropriate entries — the verbs 'cause,' 'start' and 'intend.' Such elements are missing from the analysis by Wierzbicka, published 14 years later, even though both papers set out to do the same thing: explicate the meaning of a sentence.

Closer to the tradition of generative semanticians are the illocutionary analyses presented by Wierzbicka. Here is one of these:

I suggest that you do this (x)
I say: I think it may be good if you do this (x)
I say this because I want you to think about it
I think: I do not know if you will want to do it (Wierzbicka 1991: 202)

Simultaneously with one of the works by Wierzbicka from 1992, a textbook of an artificial language came out, authored by Elmer Joseph Hankes. Its name is *Ehmay Ghee Chah*, that is, a polite foreign language. It had been conceptualized as simple and undiversified. It is supposed to operate as a *lingua franca* and be subservient to man's collaboration with the computer. The author proposed a brand new alphabet, punctuation and operational commands, concerning e.g. foreign graphical signs.

A letter of Hankes's alphabet is formed by attaching 1-3 horizontal bars to a vertical line — on its left for consonants and on the right for vowels. Between those, dots are added, which is to secure 56 possible combinations, 20 of these for vowels and 20 for consonants. The remaining ones are a reserve for writing expressions in foreign languages, i.e. foreign-language quotations (in which Hankes's alphabet resembles Japanese writing, where katakana is used for foreign words and rendering emphasis).

The sounds of *Ehmay Ghee Chah* are supposed to be pronounced separately, and so there occurs no sonorization or devoicing within a word or between two words, as it is known in Polish (*krzywda, ławka, prośba and wóz siana/wóz drutu*). In general, the pronunciation of the language is to be free from any irregularity, which will facilitate man's collaboration with a machine. All words are unambiguous. There is practically no category of case. There is a need of strict international control of the language's further development to secure fidelity in the imitation of pronunciation patterns (the textbook was distributed with a cassette). On the other hand, local communities should enrich *Ehmay Ghee Chah* with elements of their ethnic languages, such as personal and place names.

According to the author, the language he is promoting levels the playing field for everyone as it has "no evident origin." Alas, as is the case with Esperanto, the origin of the language proposed by Hankes IS evident.

In complex nominal expressions the last element is dominant, as is the case in English, where the true noun is the last one of a series, such as in 'alarm clock,' with the preceding one functioning as a modifier. Longer series illustrating the phenomenon are also possible, such as 'spring wheat grain yield.'

Concerning Hankes's language verbs, their conjugation includes present, past and future forms in perfect and continuous aspects. There is no verb-noun concord. A translation sample from English to *Ehmay Ghee Chah* suggests the following solutions related to word order: subject-predicate, possessive pronoun-noun, predicate-adverbial of place. Vocabulary is defined in English and although changes in that respect are allowable, one can expect that the coexistence of definitions in English and other language(s) can lead to unwanted ambiguities.

A further analysis of syntactic and semantic assumptions provides more evidence to prove that Hankes's language is not as deprived of a conspicuous origin as the author would have it. In writing, he proposes an alphabet rather than a syllabary (as for syllabic languages) or logograms (such as in Chinese). Half of the signs are meant for vowels and the other half for consonants, whereas in some languages the number of consonantal phonemes is dozens of times higher than the number of phonemes representing vowels; it also happens that a given language only features consonants in writing.[9] The very signs of Hankes's alphabet resemble the signs of the Ogamic language, once used by Celts in what today is Great Britain and Ireland. Individual words in the language by Hankes are separated with spaces rather than colons,[10] with the notation going from left to right. Decimal numbering and "Arabic" numerals are used. Italics are avoided; letters should be hand-printed so that collaboration with a computer would be easier. The name of the language is notable, too: *Ehmay Ghee Chah* means a polite foreign language. Impoliteness should be eliminated, and so should tendencies to merge sounds. But then *Ehmay Ghee Chah* is in fact *Eh muh ay ghee chah.*

1. FORMALISM IN LOGIC

Interest in "the forms used by logicians," as Leibniz put it, was reflected in one of the orientations in the 20^{th} century philosophy of mathematics,

[9]On the proportion of the numbers of vocalic and consonantal phonemes in various languages see Majewicz 1989: 182. Apart from Hebrew, other consonantal systems of writing include Phoenician and Ugaritic. *Cf.* Cohen 1956: 49; Comrie 1998: 162, 174.

[10]On the Ethiopian colons see Cohen 1956: 50. Comrie 1998: 176.

known as formalism. Leibniz contributed greatly to its development, and to the development of logic at large; what is particularly emphasized are his assertions about: the identity of indiscernibles, and the possibility of mutual replacement of their names while keeping the truthfulness of the sentence (Audi 1996: 429, Marciszewski 1988: 92). In criticizing linguistic designs of a universal language, we speak of details. In the case of formalism, we touch upon a fundamental question.

Formalism was started by the German mathematician David Hilbert in the 1920s. The so-called Hilbert's program proposed the formalization of mathematics in the first place (and thus the transformation of axioms, proofs and theorems into 'concrete visible objects' (Murawski 1991: 12), which one will be able to examine like objects) and, secondly, a demonstration of non-contradiction of mathematics. In Hilberts opinion, properly selected axioms will afford a possibility of solving every mathematical problem that can be formulated. "There is no *ignorabimus* in mathematics" (Murawski 1991: 12) means 'there is no WE WILL NOT KNOW.' This is how Leinbniz's dream was to come true: say all that is true without saying what is unnecessary (Murawski 1994: 92).

Unluckily for formalists, in 1931 Kurt Gödel published a paper where he proved that the arithmetic of natural numbers (and also all systems that are richer) is incomplete, meaning that we cannot determine whether some of its propositions are its theorems or not. As regards non-contradiction of a formalized theory containing the arithmetic of natural numbers, it cannot be done using the inventory of this theory only. Alfred Tarski reached similar conclusions at the time: unable to provide a formal definition of sentence for a natural language, we can neither formulate a definition of a true sentence in such a language; we also cannot give a semantic definition of the phrase 'true sentence.' Murawski (1998) writes on the mutual (in)dependencies between the two scholars. He presents the following conclusion: although Gödel was first to apply the method formulated by both of them, it was Tarski who first called the result (attained independently from Gödel) the formal undefinability of truth. Gödel in his texts, even avoided the very word 'truth,' for fear of negative reactions in his milieu.

A similar issue can be seen in languages described by the grammars concerning (fragments of) natural language. I mean the categorial grammar, started as early as in the 1930s by Kazimierz Ajdukiewicz and those created in the postwar period by Noam Chomsky and Richard Montague (Buszkowski 1989; Pietryga 2006: 376-377). It would be interesting to trace the history of Tarski and Gödel with regard to languages delimited by generative-

transformational and categorial grammars.

The very first sentence of Ajdukiewicz's famous text of 1935 "Die syntaktische Konnexität" makes reference to the 'discovery of antinomy' and ways of its resolution, which made the issues of linguistic syntax "the most important problems of logic." The text does not imply, however, that the liar's paradox is at issue but, rather, that it is the discovery, in 1901, by Bertrand Russell of the antinomy of classes (Audi 1996: 728-729).[11] This so-called 'Russell's paradox' was resolved thanks to the adoption of the theory of types, designed by Russell himself; in its simplified version it was recognized by most logicians only as late as in the 1930's. It gave rise to the discoveries by Tarski and Gödel (Marciszewski 1987: 113). Most logicians were, as can be imagined, too engrossed in the transformations under way at that time to notice these simple but ingenious thoughts.

The syntactic calculus proposed by Ajdukiewicz in further parts of the paper (Ajdukiewicz 1935) is founded upon the Husserlian conception of semantic categories (which particular words belong to) and on the functor-argument relationship between words. In many cases, a syntactic calculus so conceived enables a verification of whether one is dealing with a syntactically cohesive expression. Upon a thorough analysis of the issue, Ajdukiewicz finally notices that categorial grammar was lacking in the so-called operators (such as the general and detailed quantifiers), which in the case of some languages are indispensable for making an analysis of the type in question (and therefore, in his opinion it would be useful to "smuggle" those into the grammar, as Ajdukiewicz wrote in the last paragraph of his 1935 paper). The in-depth remarks on the issue are concluded by Ajdukiewicz with a concession of his helplessness in any further development of the method proposed.

Also the results of postwar natural language studies, which were mentioned before, ignore the existence of the Tarski-Gödel result. The work by Chomsky seeks to model human linguistic ability: grammar should formally generate correct sentences, at the same time exposing their structure. The so-called phrase structure rules indicate their permissible structure but fail to comprehensively address the issue, also due to the constantly changing terminology. The respective transformations are to secure correct supplementation of grammar details (sequence of tenses or inflection with phonology) and make possible joint derivation of like sentences (with one

[11] The antinomy is contained in this question: is a set, a member of itself even if it constitutes a set containing sets that are not members of themselves, see Marciszewski 1987: 113.

scheme applied to the affirmative and negative variants of declarative sentences). Generative-Transformational Grammar constantly evolved, forever improved by its creators to meet subsequent requirements and amend errors. In Chomsky's grammar there is no question of the truthfulness of the sentences being constructed. Kazimierz Polański must be right in saying that the transformational rules applied in this grammar were allegedly "an adaptation of the informal procedures of traditional grammar to the formalized transformational description" (Polański 1999: 217). Obviously, school grammar does not pose philosophical questions about the definition of truthfulness of the target language sentences.

What can be puzzling, though, is that Tarski's questions are not asked by Richard Montague, his doctoral student (Zygmunt 1995: XVII), who repeatedly stresses the significance of the T-scheme for his work. Although Tarski staunchly asserted the view of the essential differences between natural and formal languages, giving clear rationale for his convictions, Montague makes the opposite belief his flagship idea.[12] Supporting it with skillful formalization, he strives to present English as a formal language. Like Tarski, Montague focuses on declarative sentences, which constitute a traditional area of interest in logic, as the main carriers of logical values. Montague notes that although he still (!) cannot formalize the whole planned fragment of English, it is known where one is to head.[13] Tarski's accomplishments clearly show where the limits are found for such illusions (Tarski 1936a, Tarski 1936b, Tarski 1944, Tarski 1969; Pietryga 2006).

The limits are established by:

1. the lack of a structural definition of a natural language sentence (among formalized grammars, Chomsky's grammar is an exception; Chomsky is, incidentally, a pet 'negative hero' in Montague's texts; Montague 1970/1979: 188, 210; Pietryga 2006);

2. a list of words actually or potentially belonging to a given language that would be useful for the possible formulation of such a definition. Irrespective of the existence of such a list, what is notable is the presence/absence in its lexicon of such words as 'previous,' 'each' and

[12]Montague (1970-1979: 188) wrote that he rejected the idea that there should be a major theoretical difference between formal and natural languages.

[13]See *ibidem*. Unlike philologists, Montague was not interested in reactions by native speakers of a language to the sentences he was describing, as he treated the description as part of mathematics, for which such reactions are irrelevant. See Thomason 1979: 2.

— most importantly — 'true.' For all these words, it would be beneficial if rules for their correct use were given in the same language as the one where they belong. For a convincing emulation of natural language, its formal notation should also enable the naming of its own expressions.

If those requirements were to be met, the formal language under construction would indeed be very similar to natural language because it would permit the formulation of the paradox of a liar, with which the users of world's languages have been able to live for thousands of years. And this is where a major practical difference lies between the users of ethnic languages as such on one hand and logicians on the other.[14]

In one of the works I cited (Leibniz gave none of these a title) Leibniz expresses a belief that the implementation of his design was not only possible but outright easy, and that with the collaboration of intelligent people it would take no more than several years, which he could prove with geometrical certainty (Murawski 1994: 94). Remember that Gottfried Wilhelm Leibniz died in 1716. The fact that 200 years later it was proved on formal grounds that the formal method he had proposed had limitations was also to his own merit, though unintentionally. In the days when he worked, impossibility of finding the answer to Goedel-Tarski IGNORABIMUS was not yet actually proved among other theorems (Murawski 1991: 10).

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