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FIFTY YEARS OF PARAINCONSISTENT LOGICS

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1. This is the date of an unusually fruitful event in the chronicles of Thought in general, and Polish thought in particular. And in the history of the Alma Mater Torunensis.

On that day, during a meeting of the Mathematical and Natural Science Department of the *Societatis Scientiarum Torunensis* the late Professor Stanisław Jaśkowski presented a paper entitled "Rachunek zdań dla systemów dedukcyjnych sprzecznych" ("A propositional calculus for inconsistent deductive systems"). The following abstract of his work appeared in the journal *Reports of the Scientific Society in Toruń*, No 1 (1949):

> The author discusses the reasons inclining him to search for a propositional calculus adjusted to the needs of inconsistent theories. He analyzes a solution to this problem found in various existing systems of logic and offers a new solution. He constructs a new propositional calculus, called discursive (discussive), defining discursive implication as: "If it is possible that p then q", where the function "it is possible that p" is understood in accordance with the meaning which Lewis gave it in his system **S5**. A series of theorems of the calculus is given, along with a list of certain statements which are refuted in it.

A complete version of the work was published in Polish, with a summary in French, in *Studia Societatis Scientiarum Torunensis*, vol. 1, 1948, 55–77.

2. Thus the work described a new logic. What is so extraordinary in it? Why does it merit recollection?

The problem of the work was quite fundamental, and its solution was indeed extraordinary!

The Principle of Non-Contradiction

3. Among the pillars of human thought a fundamental role has been played by the Principle of Non-Contradiction. It prohibits the acceptance of contradiction, and together with the Principle of the Excluded Middle, dictates that the question: *Is it the case that A?*, where A has an unambiguous meaning, has exactly one of the two answers: *Yes* or *No*.

The Principle of Non-Contradiction excludes the answer: *Both yes and no*. It therefore requires that the answer be searched for and guarantees that the search is reasonable.

4. The Principle of Non-Contradiction occurs in at least four versions: METAPHYSICAL — no object can, at the same time be and not be such-and-such; LOGICAL — no unambiguous statement can be both true and false; PSYCHOLOGICAL — nobody really and seriously has contradictory experiences, i.e., nobody really sees and does not see (hears and does not hear) simultaneously, etc.; ETHICAL — no one in his right mind would simultaneously demand (or perform) A and *not-A*.

One of the most distinguished traditions which follows Socrates, Plato, Aristotle and Leibniz maintains that the metaphysical principle of non-contradiction is among the highest principles of thought. It claims also that other versions of the Principle, the logical one in particular, are secondary, derivable from the former.

These principles are correctly recognized as the cornerstone of European Rationalism. And they have served us quite well, too.

5. From the very dawn of Greek thought, however, these principles have been contested, first by some rhetoricians and sophists, later on by certain metaphysicists, and recently even by several logicians and mathematicians.

The challenge of inconsistency

6. They did not act without reason, for not infrequently were they forced to consider inconsistent theories. Let us recall here, for example, the history of mathematical analysis during the first 150 years of the development of differential and integral calculus.

7. One of the first logicians who questioned the status of the metaphysical and logical versions of the Principle of Consistency was Jan Łukasiewicz, the father of Polish logic and master of Stanisław Jaśkowski. In his classic book *O zasadzie sprzeczności u Arystotelesa* (*On the Principle of Consistency in Aristotle*) published in 1910 Łukasiewicz endorsed only the ethical version of the principle of non-contradiction, as the rule which defends us against permanent error and lie, and against madness.

Parainconsistency

8. The view of Łukasiewicz, later reintroduced and made popular by Ludwig Wittgenstein, gave rise the question of finding an interesting and sufficiently rich logic which accommodates inconsistencies, allowing for their consistent investigation.

The problem was first solved in the previously mentioned work of Łukasiewicz's student Stanisław Jaśkowski.

9. Jaśkowski's problem was fundamental, its solution profound and inspiring. His work could therefore be described as decisive, crucial for further investigation.

And that is precisely what happened.

10. Jaśkowski's point of departure was a discourse, the situation of a discussion. When one asks: *Is it the case that A?*, and does not know the answer, one often considers both possibilities at once. Likewise, when defending A, one respects, at least during a honest discussion, an opponent who claims *not-A*. Which logic applies here?

11. Usually classical logic, though not in its full power and entirety. In this situation we are not ready to accept, for example, the rule of Duns Scotus, which from the contradiction: *A and not-A* allows us to infer any statement B, i.e., to conclude just everything. This is a little too much, however.

For, in real discussions between serious and honest opponents inconsistencies neither explode nor overfill the discourse.

12. Inconsistencies must be examined. Not prejudged. Nor worshipped as idols, as in the case of most Hegelians (excluding Graham Priest and other logical philosophers, I hope).

Quite the contrary. We examine them in order to find a remedy. In search of the understanding about their sources, reasons and real consequences.

13. From this perspective, the mastery of Jaśkowski's solution is simply striking.

Firstly, he created a discursive calculus **D2**, which fulfilled all the formal criteria we tend to impose on interesting paraconsistent logics.

Secondly, his construction in its deep structure enables us to consider inconsistencies occurring in a theory $\boldsymbol{T}$ as contingent statements in a related modal theory $\mathbf{M}(\boldsymbol{T})$ playing the role of its metatheory.

Thirdly, it often allows for the consistent examination of a given inconsistency. Sometimes even for the understanding of its mechanism and sources.

Fruitfulness

14. Jaśkowski's pronouncement came just in time. In Poland in late 1940s and early 1950s, stifled under the Stalinist regime, it provided a fresh breeze of rationalism. In Poland Jaśkowski's work in that time was however singular.

On the world scene, it arrived on just few years ahead of the emergence of paraconsistent logics.

15. In 1950s, led by rather different motives and intuitions, logical investigation of inconsistencies began in Latin America in works of Florentio Asenjo from Argentina (and later, the USA) and Newton C. A. da Costa from Brazil. An especially important role in emerging paraconsistency as an autonomous logical subject has been played by Newton da Costa, the laureate of the present year Nicholas Copernicus University Medal of Merit, who is indeed one of the two (or three) co-fathers of paraconsistent logics.

In the 1960s similar investigations started within the camp of American and Australian relevant and paraconsistent logicians: Richard Routley (Sylvan), Robert Meyer, Michael Dunn, Graham Priest and others. Finally, in the 1980s paraconsistent logics made spectacular career on the borderland of logic and computer science as one of the chief families of non-monotonic logics.

In the mid 1980s its importance grew to such an extent that *Mathematical Reviews* set apart a special subsection to review paraconsistent logics.

16. Thus from one paper of Jaśkowski a new field of logic has emerged. The paper has perfectly passed the test of time and fruitfulness: *In years 'ye shall known them by their fruits.*

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