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### **A BIZARRE SITUATION WITH LAWS OF LOGICS**

In January 2024, “The Journal of Symbolic Logic” published a paper by Benjamin M. Bumpus and Zoltan A. Kocsis, “Degree of Satisfiability in Heyting Algebras” [1]. Here, the authors prove that for finite Heyting algebras, more than two-thirds of all statements satisfy the law of the excluded third. The paper by Bumpus and Kocsis may prove to be sensational, as it may indicate either a crisis in current formal logic or a revolution in current formal logic. Why the paper should be sensational, I will show in these talking points.

The Heyting algebra is a lattice (i. e., a partially ordered set) that performs the same function in intuitionistic logic as Boolean algebra does in classical logic. The fundamental difference between Heyting algebra and intuitionistic logic, and Boolean algebra and classical logic, respectively, is the formers’ rejection of the law of the excluded third. This is due to the fact that intuitionistic logic was created as a formal logical apparatus of intuitionism, which accepts as one of its principles the rejection of the law of the excluded third. The paper by Bumpus and Kocsis shows that the law of the excluded third works in Heyting algebras and in intuitionistic logic in most cases, which may mean that Heyting algebras, also called “pseudo-Boolean algebras”, are not really pseudo-Boolean algebras anymore; rather, they turn out to be Boolean algebras in most cases. Furthermore, intuitionistic logic turns out to be classical logic in most of its applications. The result obtained by Bumpus and Kocsis may have serious consequences for formal logic as a whole.

The results of Bumpus and Kocsis call into question the principles of intuitionism, or rather one of them, namely, the rejection of the law of the excluded third. The said principle is problematized here: either one must question the postulation of the said principle within intuitionism, or one must admit that intuitionists have failed to create an adequate formal logic for intuitionism. This is probably because intuitionistic

logic and Heyting algebras are built on classical logic and Boolean algebras. If the latter is true, then all non-classical logics and their algebras should be questioned, because they were created in the image of classical logic and Boolean algebra. This might blur the anyway indistinct boundaries between classical and non-classical logic, and generally allow us to claim that true non-classical logic has not been created yet. All non-classical logics are actually pseudo- or quasi-non-classical logics.

It is also recalled that Samuel Shatunovsky, a logician from Odesa and a follower of intuitionism, has shown that the law of the excluded third is not always satisfied in traditional and classical logics [2]. It can be expected that other laws of traditional and classical logic are not always satisfied when these logics are applied. This may imply that the partial satisfiability of the laws of classical logic is transferred as a property to non-classical logics, which are created in the image of classical logic. This may also be in support of the idea above, that true non-classical logics have not yet been created.

### References

1. Bumpus B. M., Kocsis Z. A. Degree of Satisfiability in Heyting Algebras. *The Journal of Symbolic Logic*, 2024, no. 1, pp. 1–19. DOI: 10.1017/jsl.2024.2
2. Шатуновский С. О. Алгебра как учение о сравнениях по функциональным модулям. Одесса: Техник, 1920. 257 с.