

- MATEUSZ ŁĘLYK, *Nonequivalent axiomatizations of PA and the Tarski Boundary*.
 Institute of Philosophy, University of Warsaw.
E-mail: mlelyk@uw.edu.pl.

We study a family of axioms expressing

$$(*) \quad \text{"All axioms of PA are true."}$$

where PA denotes Peano Arithmetic. More precisely, each such axiom states that all axioms from a chosen axiomatization of PA are true.

We start with a very natural theory of truth $CT^-(PA)$ which is a finite extension of PA in the language of arithmetic augmented with a fresh predicate T to serve as a truth predicate for the language of arithmetic. Additional axioms of this theory are straightforward translations of inductive Tarski truth conditions. To study various possible ways of expressing $(*)$, we investigate extensions of $CT^-(PA)$ with axioms of the form

$$(**) \quad \forall x (\delta(x) \rightarrow T(x)).$$

In the above (and throughout the whole abstract) $\delta(x)$ is an arithmetical Δ_0 formula which is proof-theoretically equivalent to the standard axiomatization of PA with the induction scheme, i.e. the equivalence

$$\forall x (\text{Prov}_\delta(x) \equiv \text{Prov}_{PA}(x)).$$

is provable in $I\Sigma_1$. For every such δ , the extension of $CT^-(PA)$ with axiom $(**)$ will be denoted $CT^-[\delta]$.

In particular we are interested in the arithmetical strength of theories $CT^-[\delta]$. The "line" demarcating extensions of $CT^-(PA)$ which are conservative over PA from the non-conservative ones is known in the literature as the *Tarski Boundary*. So far, there seemed to be the least (in terms of deductive strength) natural extension of $CT^-(PA)$ on the non-conservative side of the boundary, whose one axiomatization is given by $CT^-(PA)$ and Δ_0 induction for the extended language (the theory is called CT_0). In contrast to this, we prove the following result:

THEOREM 1. *For every r.e. theory Th in the language of arithmetic the following are equivalent:*

1. $CT_0 \vdash \text{Th}$
2. *there exists δ such that $CT^-[\delta]$ and Th have the same arithmetical consequences.*

Secondly, we use theories $CT^-[\delta]$ to measure the distance between $CT^-(PA)$ and the Tarski Boundary. We prove

THEOREM 2. *There exists a family $\{\delta_f\}_{f \in \omega^{<\omega}}$ such that*

1. *for every $f \in \omega^{<\omega}$, $CT^-[\delta_f]$ is conservative over PA;*
2. *if $f \subsetneq g$, then $CT^-[\delta_g]$ properly extends $CT^-[\delta_f]$;*
3. *if $f \perp g$ then $CT^-[\delta_g] \cup CT^-[\delta_f]$ is nonconservative over PA.*