On set-theoretic mereology as a foundation of mathematics

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Philosophy of Mathematics Seminar
29 October 2018

In light of the comparative success of membership-based set theory in the foundations of mathematics, since the time of Cantor, Zermelo and Hilbert, it is natural to wonder whether one might find a similar success for set-theoretic mereology, based upon the set-theoretic inclusion relation $\subseteq$ rather than the element-of relation $\in$. How well does set-theoretic mereological serve as a foundation of mathematics? Can we faithfully interpret the rest of mathematics in terms of the subset relation to the same extent that set theorists have argued (with whatever degree of success) that we may find faithful representations in terms of the membership relation? Basically, can we get by with merely $\subseteq$ in place of $\in$? Ultimately, I shall identify grounds supporting generally negative answers to these questions, concluding that set-theoretic mereology by itself cannot serve adequately as a foundational theory. This is joint work with Makoto Kikuchi and Ruizhi Yang. Post questions and commentary on my blog at `http://jdh.hamkins.org/on-set-theoretic-mereology-as-a-foundation-of-mathematics-oxford-phil-math-seminar-october-2018`.