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## Early onset of structural inequality in the formation of collaborative knowledge in all Wikimedia projects

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### Abstract

The Wikimedia project, including Wikipedia, is one of the largest communal data sets and has served as a representative medium to convey collective knowledge in the twenty-first century. Researchers have believed that the analysis of these collaborative digital data sets provides a unique window into the processes of collaborative knowledge formation; yet, in reality, most previous studies have usually focused on its narrow subsets. Here, by analysing all 863 Wikimedia projects (various types and in different languages), we find evidence for a universal growth pattern in communal data formation. We observe that inequality arises early in the development of Wikimedia projects and stabilizes at high levels. To understand the mechanism behind the observed structural inequality, we develop an agent-based model that considers the characteristics of the editors and successfully reproduces the empirical results. Our findings from the Wikimedia projects data, along with other types of collaboration data, such as patents and academic papers, show that a small number of editors have a disproportionately large influence on the formation of collective knowledge. This analysis offers insights into how various collaboration environments can be sustained in the future.