

The Vesuvius Challenge: Competitive Science as a Vehicle for Scientific Breakthroughs

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The Vesuvius Challenge (scrollprize.org) is a current machine learning and data science competition built around the goal of making visible the evidence of ink captured in micro computed tomography scans of damaged Herculaneum scrolls. The prize pool for the competition is more than \$1M. The website for the challenge states as its objective that it intends "...to make history by reading an unopened Herculaneum scroll for the very first time. We believe that an open competition will accelerate progress and enable us to achieve this goal in 2023." It is very unusual to see researchers from academia using open competitions to further their research and to accelerate progress. While there are other barriers, funding a prize pool large enough to attract many competitors is one major hurdle. This paper explores the concept of competitive science through the lens of the Vesuvius Challenge as a case study.

The promise of a large community of talented scientists and engineers working long hours without pay on a significant research project seems quite compelling. Imagine a group of several thousand people all working on the same goal, sharing code and ideas and progress, for the purpose of meeting an overall challenge. There have been competitions in the past that have produced amazing results, perhaps the most famous of which is the "Longitude Prize of 1714". The problem of navigating at sea was turned over to a government-sponsored prize called "The Longitude Act," which offered a £20,000 prize (approx £1.5m today) for a solution. Other more recent prizes (Millennium Prize; X Prizes; XTX Markets Math Olympiad Prize) hope to exploit the idea of realizing breakthrough, accelerated results through the inducements of large monetary prizes.

But there are barriers to making such offerings successful. Competitions are, well, competitive. There is no guarantee that winners can succeed, or that competitors will share innovations. It is also risky to assume large numbers of people will be able or willing to spend time working on a project that may in fact produce no return on the investment. How can talented and energetic people be convinced to spend time when the chances of winning might be very low? Of course any competition needs to offer prizes. It can be difficult or even impossible to secure a prize pool that is attractive enough to engage a substantial number of competitors. There is also the question of opening up research for the purpose of supporting a competition when research itself is competitive. What is the incentive for a research team to deliver to the open community everything that might be its own competitive advantage in the research arena? What if there is intellectual property at stake, or competing research teams that are unwilling to share and/or offer credit?

In this paper we detail the landscape and the crucial elements that make a competition a viable approach. We show how many of the hurdles and barriers can be overcome. We also discuss how the digital era facilitates the concept of competitive science like never before through the use of cloud-based computing systems, social media sharing platforms, global finance systems that make electronic transfers of prize money simple, and tutorial schemes that lower the barrier to entry for contestants who show interest.

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