Decentralised network systems of trust: Blockchain technology for scientific research

Christopher B. Germann (PhD, MSc, BSc / Marie Curie Alumnus)

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An interesting and innovative proposal is to use blockchain technologies (usually associated with digital crypto currencies like, for instance, Bitcoin or Ethereum) to counteract the replication crisis, to validate empirical findings, and to improve and optimize the scientific procedure on a large scale (Bartling & Fecher, 2016). The authors suggest that "Blockchain could strengthen science's verification process, helping to make more research results reproducible, true, and useful" (Bartling & Fecher, 2016, p. 1). Even though this proposal might seem unrealistic or overstated to those unfamiliar with blockchain technologies, we think that this is indeed an excellent innovative and creative proposal because blockchain technologies can be used in all situations which require a high degree of trust. In other words, it is a decentralised (distributed) technology which is useful in many scenarios in which trust is of central concern and it has been predicted that the "blockchain revolution" (Tapscott & Tapscott, 2016a) will influence not only online transactions, but that it will profoundly change many aspects of society which go far beyond financial services (Foroglou & Tsilidou, 2015; Grech & Camilleri, 2017; Idelberger, Governatori, Riveret, & Sartor, 2016; Tapscott & Tapscott, 2016b). Given that the replication crisis challenges the trustworthiness of scientific data, blockchain seems to be a potential candidate which should be carefully considered in this respect. The Economist called the blockchain "the trust machine" (TheEconomist, 2015). Trust "is hardcoded in the Blockchain protocol via a complex cryptographic algorithm" (Benchoufi & Ravaud, 2017). For instance, blockchain-timestamped protocols have been suggested to improve the trustworthiness of medical science (Irving & Holden, 2017). Moreover, the use of blockchain technologies has been suggested to improve clinical research quality where "reproducibility, data sharing, personal data privacy concerns and patient enrolment in clinical trials are huge medical challenges for contemporary clinical research" (Benchoufi & Ravaud, 2017). Based on these proposals and the intrinsic trustworthiness of the implemented cryptographic algorithms, it can be convincingly argued that innovative decentralised blockchain networks might become of central importance to the scientific endeavour. Specifically, it might provide a cryptographic/mathematical basis for

transparent, unbiased, and decentralised scientific research of the future. We propose the phrase "the digital decentralisation of science". An improvement of a part of the system which underlies the scientific method which only became available when sufficient computational resources became available. The decentralised nature of the system is characteristic of a general tendency towards distribution, openness, and transparency. Science and trust are obviously closely interlinked concept. Therefore, science needs to be implemented in an and ideological and technological system which intrinsically support this virtuous feature which lies at the very heart of science. Namely: Trust. In a sense, code is morality, i.e., code defines the laws under which a system operates. The current centralised publishing landscape and the associated editorial policies have all kinds of inherent procedural biases and the selectivity/publications-bias which lies at the core of the replicability crisis is just one of the many manifestations and consequences that impede and compromise the trustworthiness, integrity, and authenticity of the scientific endeavour. Openness and decentralisation is the way forward (Bohannon, 2016; McKenzie, 2017; Perkel, 2016).