# OPEN ALGORITHMIC SYSTEMS: LESSONS ON OPENING THE BLACK BOX FROM WIKIPEDIA

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## Methodological and theoretical overview
*An ethnography of algorithmic governance*

This paper reports from a multi-year ethnographic study of automated software agents in Wikipedia, where bots have fundamentally transformed the nature of the notoriously decentralized, 'anyone can edit' encyclopedia project. We studied how the development and operation of automated software agents intersected with the project's governance structures and epistemic norms. This ethnography of infrastructure (Star, 1999) involved participant-observation in various spaces of Wikipedia: both routine editorial activity in Wikipedia (which is assisted through bots) and specific work in Wikipedian bot development (including proposing, developing, and operating bots). We also conducted archival analyses of bots in the history of Wikipedia, which included tracing the development of Wikipedia's norms and governance structures alongside the development of software infrastructure.

*Algorithms are relational, embedded in social and technical systems*

We focused on these infrastructures as dynamic and relational, 'emerg[ing] for people in practice, connected to activities and structures' (Bowker, Baker, Millerand, & Ribes, 2010, p. 99). We analyzed Wikipedia's governance structure as a socio-technical system, comprised of people and algorithms that collectively constitute a fluid and ever-changing system. We emphasize the importance of understanding both code and the broader "algorithmic systems" (Seaver, 2013) in which code is embedded. This investigation is one of algorithms 'in the making,' which was possible partly because of the public ways in which Wikipedians develop and debate about bots. Like Seaver's ethnography of recommender systems, we found that algorithms studied in the making looked different than how they are often discussed in 'critical algorithms studies' literature – which often involves studying algorithms that are developed in relatively closed settings, platforms, and organizations:

> These algorithmic systems are not standalone little boxes, but massive, networked ones with hundreds of hands reaching into them, tweaking and tuning, swapping out parts and experimenting with new arrangements … When we

realize that we are not talking about algorithms in the technical sense, but rather algorithmic systems of which code *strictu sensu* is only a part, their defining features reverse: instead of formality, rigidity, and consistency, we find flux, revisability, and negotiation. (Seaver 2013, 9-10)

**Findings**
*The wisdom of bots*

Hundreds of fully- and semi-automated software agents operate across Wikipedia, and they have profound impacts on how Wikipedians accomplish the work of writing and editing an encyclopedia (Niederer & Van Dijck, 2010; Geiger, 2011; Halfaker & Riedl, 2012). In the English-language Wikipedia, 22 of the 25 most active editors are bots, and in January 2016, they made 28% of all edits to pages in the project and 20% of all edits to encyclopedia articles.[1] Bots and bot developers have long been an important part of the volunteer community of editors. The tasks that Wikipedia's bots are delegated extend to almost every aspect of the encyclopedia and the community who writes it. Bots play a particularly important role in policing articles for spam, vandalism, and plagiarism, automatically reverting edits that are determined to pass a certain threshold and passing suspicious edits to human reviewers. In fact, much of the relatively high quality and internal consistency of Wikipedia should be attributed more to a 'wisdom of bots' than just the frequently-cited (and often ill-defined) 'wisdom of crowds.' Algorithmically assisted bots and tools also play roles in newcomer socialization, as they often structure the first interaction a newcomer has with "the Wikipedia." (Halfaker, Geiger, Morgan, & Riedl, 2013; Halfaker, Geiger, & Terveen, 2014)

*The politics of bots*

Wikipedia's bots codify particular understandings of what encyclopedic knowledge ought to look like. Wikipedians have particular assumptions about how knowledge ought to be represented, and bots play a major role in enforcing these assumptions. The political implications of the automation of Wikipedia plays out even in seemingly-minor tasks like fixing spelling mistakes. In one example, the decision to potentially deploy a spellchecking bot on the English-language Wikipedia necessitated deciding what national variety of English (American, British, Canadian, etc.) ought to be used for the dictionary. This meant deciding if Wikipedia's articles will universally adhere to one national variety of English – a proposal that has been perennially rejected, leading to the rejection of fully-automated spellchecking bots.

*Bots are publicly debated and negotiated*
This example also shows how the Wikipedia community's model of technical administration dramatically differs from that of many social networking sites or task economy platforms. Bot developers must get the approval of a special committee of bot developers and non-developer Wikipedians, who publicly discuss the proposed bot's functions and potential implications, then make decisions according to a specified

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[1] Based on data from Wikimedia Labs. See http://quarry.wmflabs.org/query/7331 for all edits (including discussion pages) and http://quarry.wmflabs.org/query/7332 for edits to articles.

process. Bots are 'open algorithm,' as the approval process requires that developers describe the kind of work their bots will do and how they will do it. Bots are a frequent topic of discussion in Wikipedia's internal deliberation spaces, where bot developers and non-developers seek to build a consensus about what kinds of automated agents ought to exist in Wikipedia. (Geiger 2011) Finally, bots that use machine learning processes to identify malicious or spam content have been built to incorporate feedback about false positives or negatives, such that the editing community can take part in training these systems.

## Conclusion

Automated software agents are playing increasingly important roles in how networked publics are governed and gatekept (e.g. Crawford 2016, Diakopoulos, 2015; Gillespie, 2014; Tufekci, 2015), with internet researchers increasingly focusing on the politics of algorithms. Wikipedia's bots stand in stark contrast to other platforms that have been delegated moderation or managerial work to algorithmic systems. Typically, algorithmic systems are developed in-house, where there are few measures for public accountability or auditing, much less the ability for publics to shape the design or operation of such systems. Wikipedia's model is far from perfect, and there are substantial barriers that make it difficult for newcomers, outsiders, and even active Wikipedians to participate in these processes. Furthermore, it is not necessarily the case that all interested individuals have the expertise to participate in such processes as they currently operate. However, Wikipedia's model presents a compelling alternative to the dominant practices of automation in which algorithmic systems are developed behind closed doors and non-disclosure agreements.

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