Postdigital Science and Education
https://doi.org/10.1007/s42438-019-00069-4

ORIGINAL ARTICLES

The Good, the Bot, and the Ugly: Problematic Information and Critical Media Literacy in the Postdigital Era

Jialei Jiang[1] · Matthew A. Vetter[1]

Published online: 14 August 2019

Abstract

This paper explores Wikipedia bots and problematic information in order to consider implications for cultivating students' critical media literacy. While we recognize the key role of Wikipedia bots in addressing and reducing problematic information (misinformation and disinformation) on the encyclopedia, it is ultimately reductive to construe bots as merely having benign impacts. In order to understand bots and other algorithms as more than just tools, we turn towards a postdigital theorization of these as 'agents' that co-produce knowledge in conjunction with human editors and actors. This paper presents case studies of three specific bots on Wikipedia, including ClueBot NG, AAlertbot, and COIBot, each of which engages in some type of information validation in the encyclopedia. The activities involving these bots, illustrated in these case studies, ultimately support our argument that information validation processes in Wikipedia are complicated by their distribution across multiple human-computer relations and agencies. Despite the programming of these bots for combating problematic information, their efficacy is challenged by social, cultural, and technical issues related to misogyny, systemic bias, and conflict of interest. Studying the function of Wikipedia bots makes space for extending educational models for critical media literacy. In the postdigital era of problematic information, students should be on the alert for how the human and the nonhuman, the digital and the nondigital, interfere and exert agency in Wikipedia's complex and highly volatile processes of information validation.

Keywords Wikipedia · Critical media literacy · Bots · Postdigital · Problematic information · Misinformation · Disinformation

✉ Jialei Jiang
j.jiang2@iup.edu

Matthew A. Vetter
mvetter@iup.edu

[1] Department of English, Indiana University of Pennsylvania, 506 HSS Building, Indiana, PA 15705, USA

Introduction

The postdigital turn in education moves beyond techno-optimism (Jandrić et al. 2018; MacKenzie and Bhatt 2018; Pepperell and Punt 2000; Taffel 2016) towards the recognition of the complex consequences of technology for issues related to digital media, literacy, and information ecologies. The concurrent crisis of 'problematic information,' what Jack (2017) defines as 'inaccurate, misleading, inappropriately attributed, or altogether fabricated' information, points to a set of circumstances in which media ecologies (MacKenzie and Bhatt 2018), especially social media ecologies, fail to address challenges pertaining to authenticity, rhetorical manipulation, and the inability of educational institutions to adequately teach critical media literacy. While popular social media sites such as Facebook are most often cited as helping spread problematic information, no socially-driven media is completely unscathed. Consider the following: During a guest lecture titled 'The Post-digital U-Turn' at the University of Illinois Urbana-Champaign, Nishant Shah, professor in digital humanities, shared how he played a prank on his students at a business school by committing vandalism on Wikipedia (Unit Fellows 2017). More specifically, Shah created an inaccurate definition of a particular concept and edited the concept's Wikipedia page before the start of class. He then asked his students to define the particular concept. It turned out that 'they all took up the wrong definition that [he] put on Wikipedia and gave it back to [him].' This anecdote demonstrates how easy it continues to be to publish erroneous information, at least temporarily, on the encyclopedia 'anyone can edit' (Wikipedia:About 2019). Further, this brief example of educational vandalism in digital media also draws our attention to the exigency of interrogating problematic information in the postdigital era, an era in which Wikipedia is the fifth most popular website (The Top 500 Sites on the Web 2019) and certainly the most widely used encyclopedia.

Although Wikipedia has been recently celebrated as having 'largely avoided the 'fake news' problem' by Wikipedia co-founder Jimmy Wales himself (Harrison 2019), the encyclopedia contends with other types of problematic information on a daily basis. These forms of misinformation and disinformation include vandalism, a common problem in the crowdsourced platform (Geiger and Ribes 2010; Tran and Christen 2015); systemic biases, those related to mis-representation of marginalized identities and topics (Bazely 2018; Gallert and van der Velden 2015; Glott et al. 2010); as well as conflict of interest (COI) editing, which further endangers the neutrality of editors and articles (Pinsker 2015). In discussing the encyclopedia's capability to combat fake news, Jimmy Wales and others acknowledge Wikipedia's unique functioning (Pinsker 2015). As a socially-driven platform with multiple processes and guidelines in place for information verification, Wikipedia has both the policies and the people to address problematic information. As Wikipedia's reputation in academic and public spheres has improved, furthermore, these resources have become more recognizable and recognized (Jennings 2008; Kittur and Kraut 2008). Less well known is that 'Wikipedia would be a shambles without bots' (Nasaw 2012). Bots patrol editors' contributions and alert administrators of potential trolls and vandals (Geiger 2011; Martin 2018). They also make significant contributions in the reduction of problematic information in the encyclopedia. In using the term bot, we defer to Wikipedia's definition: 'A bot (a common nickname for a software robot) is an automated tool that carries out repetitive and mundane tasks to maintain...the English Wikipedia' (Wikipedia:Bots 2019).

Drawing insight from relevant scholarship in computer-human interaction, this article highlights three case studies of bots used to engage in problematic information detection and deletion: (1) ClueBot NG; (2) AAlertbot; and (3) COIBot. Our postdigital examination of these bots demonstrates Wikipedia as a sociotechnical system that distributes the monitoring of content and protects against problematic information through human-computer relations, agencies, and moralities. Such an examination will look more closely at the ways bots accomplish this work in concert with a complex ecology of human and non-human actors, shared social values, policies, and procedures. We argue that bots should be recognized as having the capacity to reshape (and misshape) information as well as the social system in which information flows. More than just tools, Wikipedia bots are both sociotechnical 'agents' engaging with hybrid, compositional work (Geiger 2011; Kennedy 2016, 2010) and extensions of the communities and creators in which they operate. While Wikipedia bots are used to combat fake news and problematic information, they also, at times, 'fight' against each other and revert each other's edits (Geiger and Halfaker 2017; Halfaker and Riedl 2012; Tsvetkova et al. 2017). To further complicate the issue, bots can be 'massively disruptive' (Halfaker and Riedl 2012: 81) to the Wikipedia community if they perform tasks inappropriately, which arise by and large from disagreements between bots and human editors, as well as technical problems, limitations, or 'bugs' in a bot's programming. Acknowledging and identifying the multiple ways in which bots both extend and reject socially-mediated policies and procedures of the Wikipedia community provides a significant opportunity for critical media literacy in a postdigital era. While its reputation is certainly improving, Wikipedia continues to be mistrusted by students (Boyd 2014) and discounted by (most of) academia. The complex methods through which information is processed, evaluated, authorized, and rejected in Wikipedia by various and multiple agents demonstrate the necessity of new models for critical media literacy. We conclude this paper by envisioning possibilities for postdigital education that encourage a more critical and nuanced perspective towards the use of Wikipedia bots. Such a critical perspective asks that educators and students in the humanities, sciences, and social sciences, especially those concerned with postdigital information literacy, move beyond simply categorizing bots as 'good' or 'bad.' Rather, the human and the nonhuman, the digital and the nondigital intertwine in the information and media ecology of the Wikipedia community. While this paper gestures towards pedagogical applications, we do not intend to propose a comprehensive curriculum. Rather, we view postdigital education as occurring within and beyond formal academic institutions and practices, and consider Wikipedia, as a free and open source knowledge archive, as serving an educational function beyond academia.

The Postdigital Turn in Education

The postdigital turn in education emerges from the disenchantment with digital information systems in a number of interdisciplinary fields, including music, architecture, design, and media studies, among others. Moving beyond the binary oppositions between the human and the nonhuman, the digital and the analogue (Pepperell and Punt 2000), Taffel (2016) challenges media studies scholars to bypass the dualistic logic grounded in the view of the digital as equivalent to 'the discrete samples of binary

codes' (326). In other words, the postdigital signals a rejection of oppositions to valorize a composite of binary terms. In education, researchers (Jandrić et al. 2018; MacKenzie and Bhatt 2018) have taken up postdigital theories to flesh out emerging dimensions of research in relation to critical media pedagogy. Of note in this research: the prefix 'post' is not synonymous with the connotation of 'after' in the temporal register. That is, 'post,' as in 'postdigital,' should not be simply perceived as taking shape 'after' the digital (Sinclair and Hayes 2019). Extending Taffel's (2016) attempt to go beyond the binary system of operation, Sinclair and Hayes (2019) pinpoint that, given the ubiquity of digital technologies in our society (which renders our technological understanding invisible), it is vital that education researchers account for the interconnectedness of the digital as well as the material.

The postdigital conception of technologies blurs the boundary between what have been traditionally considered as human and nonhuman, technological and non-technological. Furthermore, the postdigital also raises epistemic questions in regard to the human-machine ecology of networked learning (Jandrić et al. 2018). The field has only recently started to address the social consequences arising from the messy relationship between physical and virtual activities. The presence of algorithms in networked learning environments makes it difficult to have a clearcut delineation of human and nonhuman actions, as well as the consequences of these actions (Jones et al. 2015). The postdigital epistemic challenge also applies to fake news, misinformation, and disinformation on digital platforms. As users on social media become increasingly dependent on algorithms to decide the types of information to which they are exposed, it is worth noting that, in addition to amplifying existing sociocultural biases, algorithms also present their own biases that cannot be ignored in knowledge production. Whilst Internet giants such as Facebook and Google, in their attempts to maximize market revenues (Noble 2018; O'Neil 2016), showcase how neutral access to raw data and information is inherently oxymoronic and almost impossible (Gitelman 2013), similar epistemic challenges have emerged in other socially-driven platforms such as Wikipedia. Problematic information on the encyclopedia engenders a number of issues including vandalism, systemic biases, and COI editing, but also poses epistemic challenges to Wikipedia-based education. In this paper, we explore the issue of problematic information (Jack 2017) in Wikipedia from a postdigital lens that considers the complex interactions between bots, Wikipedia systems and policies, and human editors.

Problematic Information and Critical Media Literacy

The crisis of problematic information points to a set of circumstances in which media ecologies, especially social media ecologies, fail to address challenges pertaining to authenticity, rhetorical manipulation, and the inability of educational institutions to adequately teach critical media literacy. In 'Lexicon of Lies: Terms for Problematic Information,' Jack (2017) establishes a taxonomy for understanding the 'fake news' or post-truth information era by forwarding the term 'problematic information.' Problematic information, for Jack, is 'inaccurate, misleading, inappropriately attributed, or altogether fabricated' (1). Within this larger category, Jack distinguishes between misinformation and disinformation. Disinformation is intentional; it conveys a sense

of 'deliberately false or misleading' information for a particular purpose (Jack 2017: 3). In contrast, misinformation commonly refers to 'information whose accuracy is unintentional' (2); it needs not be intentionally false or misleading. Taken together, fake news, including hoaxes, pranks, and parodies, indeed can serve as social critique that aids in revealing the misrepresentations of truth (MacKenzie and Bhatt 2018). Nevertheless, the overreliance on fake news and misinformation makes online users more susceptible to taking the 'facts' as given, promoting a reductive understanding of complicated social problems. Furthermore, the amplification of misinformation by algorithms (Bhatt and MacKenzie 2019) and social media's 'echo chambers' (Nguyen 2018) presents historically unprecedented problems. Algorithmic structures, such as those utilized by Facebook and Google, can be designed to sway public opinions through reifying certain beliefs and ideologies while downplaying the relevance of other voices. Far from being free of biases and commercial interests, algorithmic procedures, in this way, interact with human users to reinforce asymmetrical power relations in digital media, all of which complicate the epistemic crisis of who to trust and to be afforded credibility in the postdigital era.

Problematic information hereby coincides with the danger of 'epistemic insouciance' (Cassam 2018)—a sense of indifference towards finding out the facts underlying social problems. Such a stance of indifference is particularly harmful in that it downplays trust and credibility, and in so doing, contributes to 'epistemologies of ignorance' (Alcoff 2017), a socially acceptable, 'ritualized' practice of depending on others to evaluate information. In the context of education, recent research (Bhatt and MacKenzie 2019) on students' digital and information literacy practices shows how epistemologies of ignorance have played a complex role in shaping and reshaping knowledge production of undergraduate students. This is not to say that such epistemologies of ignorance have no value. In their study of how algorithmic procedures guide students' online experience, Bhatt and MacKenzie (2019) acknowledge the benefit of such ignorance in helping us access information in an efficient manner. However, online platforms such as Google, as mentioned earlier, mediate online searches for information that are not always 'benign, neutral, and objective' (Noble 2018: 1). In digital literacy practices, rather than validating information themselves, students often rely on epistemic authorities, e.g., their teachers or algorithms, to validate information for them. In other words, students depend on others to validate information rather than engaging in exploration and evaluation processes themselves (Bhatt and MacKenzie 2019).

The limited agency exercised by students tasked with information validation becomes even more problematic when we consider the consistent and rapid evolution of new media technology and culture. An additional objective of this paper is to extend a mode for critical media literacy using our investigation of problematic information in Wikipedia as a heuristic for thinking with/through complex issues related to mis- and disinformation. For this purpose, we work with Kellner and Share's (2005) discussion. According to these scholars, critical media literacy encompasses five core concepts: (1) 'Non-Transparency: All media messages are "constructed"'; (2) 'Codes and Conventions: Media messages are constructed using a creative language with its own rules'; (3) 'Audience Decoding: Different people experience the same media message differently'; (4) 'Content and Message: Media have embedded values and points of view'; and (5) 'Motivation: Media are organized to gain profit and/or power' (374–376). While we

value the foundational role these concepts play, we also acknowledge the need for an update of Kellner and Share's (2005) model, focusing particularly on their definition and explication of the fourth core concept: students' recognition and critique of the 'embedded values' and 'subjective nature' (Kellner and Share 2005: 376) underlying new media communication. More specifically, the fourth concept focuses on the notion that students be able to challenge ideologies and values within new media's representation of issues related to race, gender, and class. Employing an example related to *Buffy the Vampire Slayer,* Kellner and Share emphasize the subjective and ideological nature of human communication but fail to thoroughly consider how non-human actors might also influence communicative acts in new media. At the same time, the non-human exploration of new media appears frequently in the works of digital rhetoric scholars (Beck 2015; Brock 2019; Brown 2015). Our extension of Kellner and Share's model, accordingly, is meant to highlight the complex distribution of subjectivity, ideology, and agency across non-human and human relations. This occurs in Wikipedia when human editors and/or social groups share a working relationship with bots, a common circumstance in the encyclopedia. In the case studies we share in this paper, furthermore, we also explore how social, cultural, and technical issues further complicate human/non-human agencies and their shared attempt to validate information. By analyzing three types of problematic information—namely, vandalism, systemic bias, and COI editing—through case studies on bot actions, we demonstrate how human-bot interactions provide opportunities for a more nuanced critical media literacy in the postdigital era.

Other efforts to engage information literacy in Wikipedia have emerged in recent years. Wiki Education (2019), a nonprofit organization devoted to supporting Wikipedia-based assignments in higher education, has promoted recent marketing campaigns in support of information literacy among college students (Davis 2016). For instance, Wiki Education has promoted information related to how to combat fake news by understanding Wikipedia's unique processes for information validation and through the critique of systemic biases. Admittedly, critiquing biases on Wikipedia helps build a solid foundation in encouraging students' critical inquiries. However, students should also be taught to understand, beyond socially-mediated processes, new media platforms and programs that work with and against each other and human editors to mediate information. The recent movement in postdigital education is most pertinent in expanding the scope of critical media literacy. A postdigital critical media literacy moves beyond the social to consider how human and nonhuman actors interfere with and exert agency in processes of information validation in Wikipedia.

The Role of Wikipedia Bots in (Mis)Shaping Information

Our understanding of the Wikipedia bot, a type of algorithmic procedure on the online platform, stems from the theorization of algorithms in the postdigital tradition. In the context of this paper, postidital theorization of digital materiality (Taffel 2016), informed by Latour's (2005) actor-network theory, is particularly conducive for understanding algorithmic procedures. Following actor-network theory, a postdigital understanding of materiality challenges the ascription of agency to human subjects and forwards a view of agency as distributed across human and nonhuman actors. This

theoretical lens advances our thinking of algorithmic procedures, such as bots, as not merely technological tools but rather social agents and actors (Geiger 2011; Kennedy 2016, 2010) exerting influences on the human-technology assemblages of online platforms. In other words, Wikipedia bots are sociotechnical 'agents' engaging with hybrid, compositional work; bot actions are entangled with the social and cultural communities in which they operate. Similarly, Kennedy (2016) turns to Latour in her analysis of the automated tasks carried out by Wikipedia bots. Kennedy posits that it is almost impossible to clearly differentiate the agency of human creators and that of the bot itself.

Due to the technocultural assemblage of multiple actors, relying solely on Wikipedia bots to patrol information inevitably generates debates and controversy within the online community. Even bots that perform tangential tasks such as adding signatures, function as social actors that are subject to the complex human-machine interplays on the encyclopedia. One notable case was the controversy over HagermanBot, which led to the bot being removed from operation (Geiger 2011). In November 2006, HagermanBot was launched to tackle the problem of Wikipedians not leaving a signature after making comments on talk pages, a discussion section of Wikipedia articles. In response to this problem, the bot automatically generated '{{unsigned}}' messages to each comment identified as missing a signature. Despite the productive editing performed by the bot, HagermanBot's action soon received complaints from Wikipedia users, who claimed that, in addition to technical and programming errors that eventually got resolved, the bot instantly signed their comments without their consent. The online community then saw the emergence of an anti-HagermanBot group that further questioned the bot's operation leading to the bot's removal from the Wikipedia platform. Following Latour, Geiger (2011) highlights the complexity in delegating social tasks to technological actors such as bots on Wikipedia. The HagermanBot controversy demonstrates the interconnectedness of technological and social mechanisms in exercising control over the online community.

To address the issue of problematic information, some of the most recognizable tasks performed by bots include alerting administrators of trolls and vandals (Geiger 2011; Martin 2018) and reverting (or deleting) mis/disinformation in Wikipedia articles. On the one hand, bots make considerable contributions to reduce fake news and problematic information; on the other hand, it is not uncommon that they also 'fight' against each other and revert each other's edits (Geiger and Halfaker 2017; Halfaker and Riedl 2012; Tsvetkova et al. 2017). More perturbingly, bot malfunction, disagreement, and failure can create disruptive results for the Wikipedia community. To put it bluntly: the actions and interactions performed by these bots in Wikipedia is messy and multiple; good, bad, and ugly. Yet, we argue that postdigital educators embrace the messy and multiple by helping students to identify and explore how bots interact with human actors in detecting and tackling problematic information. Such examinations can potentially provide a significant opportunity for a model of postdigital critical media literacy. In what follows, we present case studies of three types of bots on Wikipedia, namely—ClueBot NG, AAlertBot, and COIBot—and discuss how their actions and interactions, efficacies and failures, can be used to cultivate students' critical media literacy in Wikipedia-based education.

ClueBot NG: Vandalism as Problematic Information

As a form of problematic information, vandalism, according to Wikipedia's definition, is the 'act of editing the project in a malicious manner that is intentionally disruptive' ('Vandalism on Wikipedia' 2019). Vandalism includes the modification of textual information that is inaccurate, degrading, and offensive, and which can potentially pose harm to the subjects of the information. Since Wikipedia is an open-access platform, any editor can potentially commit vandalism. To facilitate enforcing Wikipedia's policies related to vandal detection and deletion, bots have been used to automate the task of article maintenance (Potthast et al. 2008). Furthermore, many of these actions have already been explored from a postdigital perspective. Geiger and Ribes (2010), for example, have recognized anti-vandalism as a complex epistemic process of distributed cognition, through which automatic algorithmic procedures interact with human users to collectively perform the action of fighting vandalism. Together with human editors, bots help maintain quality controls and establish the social order on Wikipedia.

While AntiVandal bots like ClueBot NG have been proven to be successful in reducing vandalism, they are not completely sufficient to counteract Wikipedia's culture of biases and problematic information, an important lesson for both students and instructors seeking to better understand digital information ecologies. Launched by Wikipedia users Christopher Breneman and Cobi Carter, ClueBot NG is one of the most prolific bots used to combat vandalism on the encyclopedia. As of June, 2014, the bot had contributed a total of 2,898,217 edits, and was ranked as the fifth most productive Wikipedia bot (Wikipedia:List of Bots by Number of Edits 2018). Geiger and Halfaker's (2013) study on bot performance reveals that ClueBot NG is particularly effective in removing fake information on Wikipedia. When ClueBot NG was disabled for four weeks in 2011, for example, no other bot was as capable in responding to issues of vandalism quickly and efficiently (Geiger and Halfaker 2013).

One prominent example of vandalism in which ClueBot NG intervened involved the Wikipedia page on Sarkeesian (Wikipedia: Anita Sarkeesian 2019), a feminist game critic and victim of the Gamergate harassment campaign. While much of the Gamergate harassment, which included misogynistic threats and violent hate speech, occured in Twitter, Reddit, 4chan and other platforms (Holmes and Lussos 2018), the controversy extended to Wikipedia as well. In 2012, Sarkeesian created a project that aimed to launch fundraising for a handful of videos produced on the topic of sexism in videogames and game culture. Her project was met with hostility, with her Wikipedia page subject to vandalism by more than twelve anonymous editors (Wikipedia:Vandalism on Wikipedia 2019). These incidents of vandalism included offensive references to her Jewish heritage, as well as problematic additions of pornographic images, among other forms of vandalism (Lewis 2012). Many of the vandalizing edits eventually disappeared on Wikipedia due to the site's policy of 'revision deletion,' which demands that 'grossly degrading, insulting, or offensive materials' be removed from the history pages of editors' contributions (Wikipedia:Revision Deletion 2019). Irrespective of the difficulty in retrieving the editing history of Sarkeesian's Wikipedia page, on June 6th, 2012, the article history shows ClueBot NG (User:ClueBot NG 2010) intervened three times to remove vandalism. Additionally, on March 7th, 2013, the bot reverted the vandalism edits by Wikipedia user Balobo,

who deleted Sarkeesian's background information and added disparaging comments including 'jew' and 'gamer girl' (User contributions:Balobo 2013). ClueBot NG removed the problematic information and restored the previous contributions to Sarkeesian's page.

Despite the bot's success in removing vandalism, however, the issue of gender bias and harassment by no means vanishes from the Wikipedia community. In January 2015, for example, the site's arbitration committee ruled to 'exclude editors deemed 'disruptive' from participating in the article documenting the still-unfolding campaign of anti-feminist harassment dubbed "gamergate"' (Famiglietti 2015: 1). In other words, the arbitration committee sanctioned Wikipedia editors who worked against the online harassment subsequent to the incident, while allowing 'gamergaters' to continue editing the articles pertaining to gamergate. While it may be precipitous to claim that feminist editors have been purged from editing articles in question, sanctions like this constitute additional social actors that complicate the work done by the bot in reducing vandalizing edits on Wikipedia. A postdigital examination of ClueBot NG, and of this particular instance of misogynistic vandalism, would allow students to recognize that despite the positive role played by the AntiVandal bot in reverting problematic information, bots alone are insufficient to completely mediate Wikipedia's sexist culture. Furthermore, because of Wikipedia's dominance in public knowledge (The Top 500 Sites on the Web 2019), such a realization has implications for multiple audiences and stakeholders beyond formal academic institutions, including everyday Wikipedia community members as well as Internet users that rely on Wikipedia.

AAlertBot: Gender Gap as Problematic Information

The second type of problematic information identified in this paper explores an issue related to the sexist culture cited above: Wikipedia's systemic biases, especially those related to mis-representation of marginalized identities and topics (Bazely 2018; Gallert and van der Velden 2015; Glott et al. 2010). One of the most well-documented biases in Wikipedia is its gender gap, which refers to the result of a predominance of male editors and the correlating uneven participation and coverage of marginalized groups, especially on women and subjects of interest to women (Collier and Bear 2012; Glott et al. 2010; Gruwell 2015; Wadewitz 2013). A global Wikipedia survey conducted by a partnership between United Nations University and UNU-MERIT found that only 13% of Wikipedia contributors are women (Glott et al. 2010). More recent studies demonstrate how the lack of women editors contributes to ongoing problems of gender representation. For instance, a recent study of biographical articles in Wikipedia across languages found that only 21% of the biographies in the English Wikipedia focused on women figures (Wikipedia Human Gender Indicator 2019).

As is apparent from research cited above, Wikipedia's gender gap is well-documented; however, little research has identified the gap as a type of misinformation mediated by both human and non-human actors, i.e. bots. One bot in Wikipedia that plays a significant role in mediating the gender gap is AAlertbot. AAlertbot 'delivers article alert report pages to subscribed projects and task forces' (User:AAlertBot 2018). An article alert refers to a tagging system used in Wikipedia to identify pages that 'enter and leave certain maintenance workflows' (User:AAlertBot 2018). For instance, pages

may be tagged with 'WP:FAC' (Wikipedia:FAC 2019) to indicate that an article has been put forth as a featured article candidate, the highest assessment of quality an article can evolve to. Conversely, pages can also be tagged with an article alert that identifies it as 'WP:AfD' (Wikipedia:AfD 2019), Articles for Deletion, which initiates a discussion among editors about the article's quality and/or notability, and whether or not it should be removed from the encyclopedia's mainspace. AAlertbot can create lists or 'article alert report pages' for projects or task forces that subscribe to its services. Thousands of projects and task forces in Wikipedia specialize in certain editing, administration, or maintenance tasks. Many WikiProjects, for instance, encourage a community of members to work on developing a particular subject area in Wikipedia. A well-known WikiProject that tackles the gender gap, is Wikiproject:Women in Red (WiR). When an internal link is red in Wikipedia, this indicates that a page has not yet been created about that subject. Women in red, then, are notable women figures that do not (yet) have their own Wikipedia article. The Women in Red WikiProject clearly states that its 'objective is to turn 'redlinks' into blue ones within the project scope: women's biographies, works by women, and women's issues' (Wikipedia:Women in Red 2019). While the project of WiR is carried out by hundreds of human volunteers, the project also relies on bots such as AAlertBot. In fact, AAlertBot maintains and updates WiR's 'Article Alerts' page which lists, among others, the following categories of article alerts: 'Did You Know' (DYN); 'Articles for Deletion' (AfD); and 'Good Article Nomination' (GAN). The consistent updating and maintenance of articles in these categories by AAlertbot allows human WiR volunteers to identify articles in their purview that have been noticed because of their high quality (GAN) or, more importantly, have been targeted for deletion (AfD). The AfD alerts allow human volunteers to enter into a discussion about the targeted article to either defend or update its quality, and accordingly, work towards the objectives of WiR.

Conversely, AAlertbot's administrative tasks can also aid editors and WikiProjects whose goals conflict with WiR. Because AfD alerts do not promote either the deletion or retention of identified articles, other editors may seek to support their deletion. AAlertBot also populates content in the Article Alerts page (Wikipedia:Article Alerts 2018), including AfD information. Editors subscribing to the Wikipedian philosophy of deletionism, which advocates for a more condensed encyclopedia, will engage with AAlertBot's lists in a way that promotes further deletion of certain articles, including biographical articles on women which don't meet certain notability requirements, although such requirements have been shown to be inherently biased (Cecco 2018).

The case study of AAlertBot ultimately demonstrates how bots aid WikiProjects such as WiR in the identification of articles that may require editorial action in order to accomplish the goals of their WikiProject. Conversely, AAlertBot may also support a myriad of other editorial actions and philosophies that work against the goals of WiR. A postdigital critical media literacy that is attentive to issues beyond the social mediation of problematic information would encourage students as well as Wikipedia users and editors to investigate the ways in which bots and other algorithms are deployed and taken up by disparate and conflicting social actors. Bots may serve multiple ideological aims concurrently, and may provide support for social groups which both uphold and challenge a particular status quo in new media. In this way, the moralities of bots are incoherent and often arbitrary in their allegiances to multiple and separate social actors. Such a realization involves a complex look at the ways certain

values are not only embedded in new media (Kellner and Share 2005); it also involves an understanding in which those values evolve or mutate across different social uptakes when a bot or algorithm is engaged in multiple tasks.

A postdigital understanding that moves beyond optimistic views of technology would recognize how bots are taken up for multiple goals and social groups, as is the case with AAlertBot, discussed previously, and also in algorithmic intervention on other social platforms; it would also demonstrate how bots often fail to perform the task they were designed to perform. In the final case study, we discuss an additional type of problematic information, conflict of interest, demonstrating how COIBot failed to effectively identify and combat this issue, and how that demonstrates the duality of human-computer interaction.

COIBot: Conflict of Interest as Problematic Information

While it hasn't received the amount of critical attention that the gender gap has, an additional type of problematic information that poses a major problem in Wikipedia is the issue of conflict of interest (COI) editing. COI editing occurs when an editor makes a contribution to the encyclopedia that is about themselves, their 'family, friends, clients, employers, or [their] financial and other relationships.' Wikipedia policy further states that 'COI editing is strongly discouraged on Wikipedia [because it] undermines public confidence and risks causing public embarrassment to the individuals and companies being promoted' (Wikipedia:Conflict of Interest 2019). Some of the most well-known cases of COI editing typically involve editors with a vested commercial interest, making changes to articles for the purpose of promotion or improved marketability of a product or company, as was the case with Microsoft in 2007 (Wikipedia:Conflict-of-Interest Editing on Wikipedia 2019). However, paid editing and political propaganda have also been a historical problem in Wikipedia. In a documented case from 2006, it was discovered that users with United States Government IP addresses were editing Wikipedia articles on political figures. Such edits were shown to have 'removed accurate but critical information and embellished positive descriptions' of political figures (mainly congressional representatives and senators) (Wikipedia:Conflict-of-Interest Editing on Wikipedia 2019).

Because COI editing is such a problematic issue in Wikipedia, efforts to respond to this problem have included the creation of bots specifically designed to detect and address COI issues. One such bot is COIBot, which 'tries to track edits that are made by users who may have a conflict of interest' (User:COIBot 2019). COIBot works primarily by attempting to 'associate a users' username (or IP [address]) with the material they are editing.' COIBot can detect COI editing, for instance, in three scenarios: (1) when 'a username [is] similar to the name of the page the user is editing,' (2) when a 'username [is] similar to the external links a user is adding,' and (3) when a 'user-IP (in case of IP users) [is] in close proximity of [the] IP of [a] domain (external link) a user is adding' (User:COIBot 2019).

This associative algorithm is useful and effective for much of the COI editing in Wikipedia; however, it cannot always detect and respond to conflicted editorial actions in which a username or IP has no explicit association with the article or links to an article. By discussing a case in which a bot fails to respond to disinformation, below, we argue that a more comprehensive critical media literacy should also include attention to the ways bots fail

to perform their intended function (in Wikipedia) as well as an attention to the resulting problems related to editor reliance on automated processes.

A case of COI that received media attention but that was not detected or responded to by COIBot, was the editing of the Wikipedia article 'Death of Eric Garner' by contributors using IP addresses corresponding to the New York Police Department (NYPD). Garner's death garnered media and public attention for at least two reasons. First, a controversial choke-hold by NYPD led to his death in a confrontation over a misdemeanor-level crime. Second, his death also coincided with the public's vocal response to police brutality and systemic racism via the #BlackLivesMatter movement. The specific COI edits in questions were made from an IP address matching the address of the NYPD: 1 Police Plaza, New York, NY. These edits attempted to minimize the description of the confrontation to avoid language related to police brutality. For example, an anonymous IP-user edited the phrase 'Garner raised both his arms in the air' to read 'Garner flailed his arms about as he spoke,' and revised the condition that paramedics responded to from 'chokehold' to 'respiratory distress' (Ohlheiser 2015; Weill 2015). Weill, writing for Politico, cites the revision to demonstrate these changes (Wikipedia:Death of Eric Garner revision diff1 2014; Wikipedia:Death of Eric Garner revision diff2 2014). The fact that these edits were made mere hours after a Staten Island grand jury failed to indict officer Daniel Pantaleo in Garner's death (Weill 2015), when the public would be most likely to google Garner and consult the Wikipedia article, demonstrates the significance of such disinformation efforts. Furthermore, the fact that COIBot was not able to detect these COI edits reveals an important gap in previous critical media literacy models that address social or collaborative platforms. Educators need literacy models to go beyond an understanding of media as having 'embedded values' or 'points of view' (Kellner and Share 2005). Critical media literacy should also include an awareness of how even bots designed to respond to embedded bias can fail to detect that bias. For example, while bots may be programmed to deal with COI editing, certain editorial actions in Wikipedia do not meet the algorithmic criteria (dependent as it is on some type of explicit association between the IP or user and the subject being edited), and are left undetected. The implications stemming from this particular case for critical media literacy are both numerous and significant, especially if we consider the consequences of bot failure for editorial practices. It is significant that the bot fails, certainly; but it is also significant that Wikipedia editors may rely on the bot's successful function, and may come to rely on automation that is not always effective. As we move into a postdigital era, educators, students, and Internet users overall will need to be more critically aware of the affordances and constraints of bots and other algorithms (within and outside of Wikipedia). Yet, we will also need to continue to invest in and value the analytical ability of humans—especially to make connections between media producer or rhetoric, ideology, and any other available information the network provides us (whether it be IP address or something else)—in order to protect against the overreliance on automation.

Envisioning a Postdigital Future of Critical Media Literacy

To cultivate students' critical media literacy, it is important that they move beyond a simple categorization of Wikipedia bots as 'good' or 'bad,' 'benign' or 'malicious.'

Quite the opposite; we forward Sinclair and Hayes's (2019) assertion that a postdigital perspective on education recognizes how 'digital technology is something in which we are entangled in complex ways, and which is embedded in the wider culture.' Programmed to reduce misinformation and disinformation, Wikipedia bots, not unlike twitter bots, operate in complex media ecologies with and against the aims of multiple human actors and social task force groups. To address the epistemic challenge of information validation, we encourage educators and students to question the current epistemic crisis related to problematic information on Wikipedia, and in the process, activate a pedagogy of postdigital critical media literacy which starts with, but also moves beyond the encyclopedia.

Towards a Pedagogy of Postdigital Critical Media Literacy

Examinations of the functioning of Wikipedia bots create space for extending educational models for critical media literacy (Kellner and Share 2005). The complex activities involving ClueBot NG, AAlertbot, and COIBot, in particular, provide support for our argument that information validation processes in Wikipedia are complicated by their distribution across multiple human-computer relations and agencies. While all three bots were programmed specifically to combat problematic information, their efficacy is challenged by social, cultural, and technical issues related to misogyny, systemic bias, and conflict of interest. Furthermore, each case study provides a specific point of development for critical media literacy. Such a literacy would not only be relevant for students and educators at formal institutions of higher education, however, and we have attempted to demonstrate the importance of these developments for everyday Internet users as well as Wikipedia community members themselves.

ClueBot NG, which was designed to tackle vandalism in Wikipedia, demonstrates the capability of bots to identify and revert vandalism in the encyclopedia. In particular, our case study of this bot showed multiple instances where it was able to both detect and remove (by reverting an edit) problematic information. However, ClueBot NG's anti-vandalism function remains largely isolated and somewhat unnoticed in the larger, male-dominated culture of Wikipedia. A postdigital examination of this case study, furthermore, demonstrates the incapability of bots to effectively mediate the encyclopedia's sexist culture, which often goes beyond isolated acts of vandalism and infiltrates governing bodies (such as the arbitration committee) in Wikipedia as well.

In our second case study, we examined AAlertBot, which is used in Wikipedia to notify editors and task force groups of administrative and categorical changes to articles. The case of AAlertBot is significant because it demonstrates how bots and other algorithms are deployed and taken up by disparate and, at times, conflicting sociotechnical agents. Bots (and, by extension, any algorithm) may serve multiple ideological or rhetorical aims simultaneously. In the case of AAlertBot, a bot can provide support for multiple WikiProjects (primarily human task force groups) with conflicting goals. Making this realization is crucial to a developed critical media literacy because it allows us to see how the agencies and intentions of nonhuman actors are both distributed and conflicted across multiple sociotechnical interactions and agendas.

The final case study of COIBot highlights the failure of a bot to detect problematic information and to function as it was programmed. COIBot failed to detect the conflict of interest editing in the article on the death of Eric Garner because its associative algorithm was not able to make a connection between the edits being made and the information provided by a basic WHOIS query on an IP address. The ability to look closer at how a bot actually functions, and where it might fall short, ultimately provides the most useful lesson from this case study for an extended critical media literacy. We might attend to, for instance, the overreliance on bots, and automation overall, and how that overreliance challenges editorial practices surrounding problematic information. But the case of NYPD editing also provides justification for a pedagogy that might encourage ongoing and conscious interrogation of IP transparency in online digital spaces. Students and everyday users need to understand the basics of a WHOIS query, for instance, and be able to make a critical analysis of how information from such a query could be linked to the formation of content in digital media.

Conclusion

In this paper, we examine the role of Wikipedia bots in responding to problematic information on the encyclopedia. Problematic information, including types of misinformation and disinformation, points towards the urgency of building critical media literacy that has the potential to help students ward off the danger embedded in 'epistemologies of ignorance' in online and offline spaces (Alcoff 2017; Bhatt and MacKenzie 2019). Instead of relying on algorithmic procedures and other authorities to evaluate information for them, students should take a more critical stance towards algorithmic mechanisms such as Wikipedia bots. By deploying a postdigital theorization of bots, we have further worked towards enriching the framework of critical media literacy (Kellner and Share 2005). In other words, our postdigital examination of bots not only acknowledges the ideological nature of the Wikipedia community, but also recognizes bots as 'agents' that co-produce meanings with other social actors and human editors. Even though bots have contributed to the epistemic process of information validation on Wikipedia, the process has inevitably been made messy by the infiltration of misogyny, systemic bias, and conflict of interest on the online platform. A postdigital critical media literacy would encourage students to become more reflexive of online information validation through identifying and analyzing bot-human interaction.

While Wikipedia is our central subject in this paper, we also call for investigations of the use of bots, spimes, and other nonhuman agents across digital platforms and programs in the postdigital era. Ultimately, we assert that educators in the humanities, sciences, and social sciences—especially those working to develop students' computer, information, and communication literacies—should provide opportunities for students to make realizations about the interference and agency of both human and non-human actors in digital spaces, as well as the complex relationships between these two categories.

While scholars such as Holmes and Lussos (2018) have called for inventive programming of bots as a pedagogical intervention, our contribution suggests that students analyze and trace bot interaction within communities such as Wikipedia. For example, students might be asked to browse the history pages of Wikipedia bots and conduct a rhetorical analysis of bot actions. Our recognition of the insufficiency of bots

to address cultural problems related to sexism and racism, furthermore, points to a larger issue that requires critical and pedagogical attention: the connection between problematic information and cultural marginalization. As they help students explore these and other postdigital concerns, we encourage educators to be careful not to reify students' inherited assumptions about digital media—but to consciously ask them to challenge such assumptions towards more nuanced, postdigital understandings.

References

Alcoff, L. M. (2007). Epistemologies of ignorance: Three types. In S. Sullivan & N. Tuana (Eds.), *Race and epistemologies of ignorance* (pp. 39–58). Albany: State University of New York Press.

Bazely, D. (2018). Why Nobel prize winner Donna Strickland didn't have a Wikipedia page. The Washington Post, 8 October. https://www.washingtonpost.com/outlook/2018/10/08/why-nobel-winner-donna-strickland-didnt-have-wikipedia-page/?utm_term=.cedfbbe4ae8e. Accessed 5 May 2019.

Beck, E. (2015). The invisible digital identity: Assemblages in digital networks. *Computers and Composition, 35*, 125–140. https://doi.org/10.1016/j.compcom.2015.01.005.

Bhatt, I., & MacKenzie, A. (2019). Just google it! Digital literacy and the epistemology of ignorance. *Teaching in Higher Education, 24*(3), 302–317. https://doi.org/10.1080/13562517.2018.1547276.

Boyd, D. (2014). *It's complicated: The social lives of networked teens*. New Haven: Yale University Press.

Brock, K. (2019). *Rhetorical code studies: Discovering arguments in and around code*. Ann Arbor: University of Michigan Press.

Brown, J. (2015). *Ethical programs: Hospitality and the rhetorics of software*. Ann Arbor: University of Michigan Press.

Cassam, Q. (2018). Epistemic insouciance. *Journal of Philosophical Research, 43*, 1–20. https://doi.org/10.5840/jpr2018828131.

Cecco, L. (2018). Female Nobel prize winner deemed not important enough for Wikipedia entry. The Guardian, 3 October. https://www.theguardian.com/science/2018/oct/03/donna-strickland-nobel-physics-prize-wikipedia-denied. Accessed 5 May 2019.

Collier, B., & Bear J. (2012). Conflict, confidence, or criticism: An empirical examination of the gender gap in Wikipedia. *The ACM Conference on Computer Supported Cooperative Work*, pp. 383-92. https://doi.org/10.1145/2145204.2145265.

Davis, L. (2016). Why wiki Education's work combats fake news — And how you can help. Wiki Edu. https://wikiedu.org/blog/2016/11/21/why-wiki-eds-work-combats-fake-news-and-how-you-can-help/. Accessed 5 May 2019.

Famiglietti, A. (2015). Adieu Wikipedia: Understanding the ethics of Wikipedia after gamergate. *The 16th Annual Meeting of the Association of Internet Researchers*, *AoIR*, pp.1-8.

Gallert, P., & van der Velden, M. (2015). The sum of all human knowledge? Wikipedia and indigenous knowledge. *At the Intersection of Indigenous and Traditional Knowledge and Technology Design*, 117–133.

Geiger, R. S. (2011). The lives of bots. In G. L. Geert & N. Tkacz (Eds.), *Critical point of view: A Wikipedia reader* (pp. 78–93). Amsterdam: Institute of Network Cultures.

Geiger, R. S., & Halfaker, A. (2013). When the levee breaks: Without bots, what happens to Wikipedia's quality control processes? In *WikiSym* (pp. 1-58). ACM. https://doi.org/10.1145/2491055.2491061.

Geiger, R. S., & Halfaker, A. (2017). Operationalizing conflict and cooperation between automated software agents in Wikipedia: A replication and expansion of "even good bots fight". *Proceedings of the ACM on Human-Computer Interaction*, *1*(CSCW), pp. 49:2-49:33. https://doi.org/10.1145/3134684.

Geiger, R. S., & Ribes, D. (2010). The work of sustaining order in Wikipedia: The banning of a vandal. In *CSCW 2010* (pp. 6-10). ACM. https://doi.org/10.1145/1718918.1718941.

Gitelman, L. (2013). *"raw data" is an oxymoron*. Cambridge, MA: MIT Press.

Glott, R., Schmidt, P., & Ghosh, R. (2010). Wikipedia survey - Overview of results. http://www.ris.org/uploadi/editor/1305050082Wikipedia_Overview_15March2010-FINAL.pdf. Accessed 5 May 2019.

Gruwell, L. (2015). Wikipedia's politics of exclusion: Gender, epistemology, and feminist rhetorical (in)action. *Computers and Composition, 37*, 117–131. https://doi.org/10.1016/j.compcom.2015.06.009.

Halfaker, A., & Riedl, J. (2012). Bots and cyborgs: Wikipedia's immune system. *IEEE Computer Society, 45*, 79–82. https://doi.org/10.1109/MC.2012.82.

Harrison, S. (2019). Happy 18th birthday, Wikipedia! Let's celebrate the internet's good grown-up. Washington Post, 14 January. https://www.washingtonpost.com/opinions/happy-18th-birthday-wikipedia-lets-celebrate-the-internets-good-grown-up/2019/01/14/e4d854cc-1837-11e9-9ebf-c5fed1b7a081_story.html?utm_term=.2f433889ec97. Accessed 5 May 2019.

Holmes, S., & Lussos, R. G. (2018). Cultivating *metanoia* in twitter publics: Analyzing and producing bots of protest in the #GamerGate controversy. *Computers and Composition, 47*, 118–138. https://doi.org/10.1016/j.compcom.2018.03.010.

Jack, C. (2017). Lexicon of lies: Terms for problematic information. Data & Society, 9 August. https://datasociety.net/output/lexicon-of-lies/ . Accessed 5 May 2019.

Jandrić, P., Knox, J., Besley, T., Ryberg, T., Suoranta, J., & Hayes, S. (2018). Postdigital science and education. *Educational Philosophy and Theory, 50*(10), 893–899. https://doi.org/10.1080/00131857.2018.1454000.

Jennings, E. (2008). Using Wikipedia to teach information literacy. *College & Undergraduate Libraries, 15*(4), 432–437. https://doi.org/10.1080/10691310802554895.

Jones, C., Ryberg, T., & de Laat, M. (2015). Networked learning. In M. Peters (Ed.), *Encyclopedia of educational philosophy and theory*. Singapore: Springer.

Kellner, D., & Share, J. (2005). Toward critical media literacy: Core concepts, debates, organizations, and policy. *Discourse: Studies in the Cultural Politics of Education, 26*(3), 369–386. https://doi.org/10.1080/01596300500200169.

Kennedy, K. (2010). Textual machinery: Authorial agency and bot-written texts in Wikipedia. In M. Smith & B. Warnick (Eds.), *The responsibilities of rhetoric* (pp. 303–309). Long Grove: Waveland Press.

Kennedy, K. (2016). *Textual curation: Authorship, agency, and technology in Wikipedia and Chambers's Cyclopædia*. Columbia: The University of South Carolina Press.

Kittur, A., & Kraut, R. E. (2008). Harnessing the wisdom of crowds in wikipedia: Quality through coordination. In *Proceedings of the 2008 ACM conference on Computer supported cooperative work* (pp. 37-46). ACM. https://doi.org/10.1145/1460563.1460572.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Clarendon.

Lewis, H. (2012). Dear the internet, this is why you can't have anything nice. New Statesman America, 12 June. https://www.newstatesman.com/blogs/internet/2012/06/dear-internet-why-you-cant-have-anything-nice. Accessed 5 May 2019.

MacKenzie, A., & Bhatt, I. (2018). Lies, bullshit and fake news: Some epistemological concerns. *Postdigital Science and Education*. https://doi.org/10.1007/s42438-018-0025-4 .

Martin, B. (2018). Persistent bias on Wikipedia: Methods and responses. *Social Science Computer Review, 36*(3), 379–388. https://doi.org/10.1177/0894439317715434.

Nasaw, D. (2012). Meet the 'bots' that edit Wikipedia. BBC News, 25 July. https://www.bbc.com/news/magazine-18892510. Accessed 5 May 2019.

Nguyen, T. C. (2018). Echo chambers and epistemic bubbles. *Episteme*, 1–21. https://doi.org/10.1017/epi.2018.32 .

Noble, U. N. (2018). *Algorithms of oppression: How search engines reinforce racism*. New York: New York University Press.

O'Neil, C. (2016). *Weapons of math destruction: How big data increases inequality and threatens democracy*. New York: Crown Publishers.

Ohlheiser, A. (2015). Eric Garner's Wikipedia page was edited from an NYPD computer, NYPD admits. Washington Post, 16 March. https://www.washingtonpost.com/news/post-nation/wp/2015/03/16/eric-garners-wikipedia-page-was-edited-from-an-nypd-computer-the-nypd-admits/?noredirect=on&utm_term=.951097ef2128. Accessed 5 May 2019.

Pepperell, R., & Punt, M. (2000). *The postdigital membrane: Imagination, technology, and desire*. Bristol: Intellect.

Pinsker, J. (2015). The covert world of people trying to edit Wikipedia for pay. The Atlantic, 11 August. https://www.theatlantic.com/business/archive/2015/08/wikipedia-editors-for-pay/393926/. Accessed 5 May 2019.

Potthast, M., Stein, B., & Gerling, R. (2008). Automatic vandalism detection in Wikipedia. In C. Macdonald, I. Ounis, V. Plachouras, I. Ruthven, & R. W. White (Eds.), *Advances in information retrieval* (pp. 663–668). Berlin: Springer.

Sinclair, C., & Hayes, S. (2019). Between the post and the com-post: Examining the postdigital "work" of a prefix. *Postdigital Science and Education*, *1*(1), 119–131. https://doi.org/10.1007/s42438-018-0017-4 .

Taffel, S. (2016). Perspectives on the postdigital: Beyond rhetorics of progress and novelty. *Convergence, 22*(3), 324–338. https://doi.org/10.1177/1354856514567827.

The Top 500 Sites on the Web. (2019). Alexa. https://www.alexa.com/topsites . Accessed 5 May 2019.

Tran, K., & Christen, P. (2015). Cross-language learning from bots and users to detect vandalism on Wikipedia. *IEEE Transactions on Knowledge and Data Engineering, 27*(3), 673–685. https://doi.org/10.1109/TKDE.2014.2339844.

Tsvetkova, M., Garcia-Gavilanes, R., Fioridi, L., & Yasseri, T. (2017). Even good bots fight: The case of Wikipedia. *PLoS One, 12*(2), 1–13. https://doi.org/10.1371/journal.pone.0171774.

Unit Fellows. (2017). The post-digital U-turn-with Lawrence Liang and Nishant Shah. YouTube, 10 May. https://www.youtube.com/watch?v=5hP33dwM28g. Accessed 5 May 2019.

User contributions:Balobo. (2013). Wikipedia. https://en.wikipedia.org/wiki/Special:Contributions/Balobo. Accessed 5 May 2019.

User:AAlertBot. (2018). Wikipedia. https://commons.wikimedia.org/wiki/User:AAlertBot, Accessed 5 May 2019.

User:ClueBot NG. (2010). Wikipedia. https://en.wikipedia.org/wiki/User:ClueBot_NG. Accessed 5 May 2019.

User:COIBot. (2019). Wikipedia. https://en.wikipedia.org/wiki/User:COIBot. Accessed 5 May 2019.

Wadewitz, A. (2013). Wikipedia's gender gap and the complicated reality of systemic gender bias (web log post). Hastac, 26 July. https://www.hastac.org/blogs/wadewitz/2013/07/26/wikipedias-gender-gap-and-complicated-reality-systemic-gender-bias. Accessed May 5 2019.

Weill, K. (2015). Edits to Wikipedia pages on bell, Garner, Diallo traced to 1 police plaza. Politico, 13 March. https://www.politico.com/states/new-york/city-hall/story/2015/03/edits-to-wikipedia-pages-on-bell-garner-diallo-traced-to-1-police-plaza-087652 . Accessed 5 May 2019.

Wiki Education. (2019). https://wikiedu.org. Accessed 5 May 2019.

Wikipedia Human Gender Indicator. (2019). Gender by language. http://whgi.wmflabs.org/gender-by-language.html. Accessed 5 May 2019.

Wikipedia:About. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:About. Accessed 28 June 2019.

Wikipedia:AfD. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Articles_for_deletion. Accessed 5 May 2019.

Wikipedia:Anita Sarkeesian (2019). Wikipedia. https://en.wikipedia.org/wiki/Anita_Sarkeesian . Accessed 5 May 2019.

Wikipedia:Article Alerts. (2018). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Article_alerts. Accessed 5 May 2019.

Wikipedia:Bots. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Bots. Accessed 28 June 2019.

Wikipedia:Conflict of Interest (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Conflict_of_interest. Accessed 5 May 2019.

Wikipedia:Conflict-of-Interest Editing on Wikipedia (2019). Wikipedia. https://en.wikipedia.org/wiki/Conflict-of-interest_editing_on_Wikipedia . Accessed 5 May 2019.

Wikipedia:Death of Eric Garner: Difference between revisions 1. (2014). Wikipedia. https://en.wikipedia.org/w/index.php?title=Death_of_Eric_Garner&diff=prev&oldid=636522175 . Accessed 5 May 2019.

Wikipedia:Death of Eric Garner: Difference between revisions 2. (2014). Wikipedia. https://en.wikipedia.org/w/index.php?title=Death_of_Eric_Garner&diff=prev&oldid=636522333 . Accessed 5 May 2019.

Wikipedia:FAC. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Featured_article_candidates. Accessed 8 May 2019.

Wikipedia:List of Bots by Number of Edits. (2018). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:List_of_bots_by_number_of_edits. Accessed 5 May 2019.

Wikipedia:Revision Deletion. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:Revision_deletion. Accessed 5 May 2019.

Wikipedia: Vandalism on Wikipedia. (2019). Wikipedia. https://en.wikipedia.org/wiki/Vandalism_on_Wikipedia . Accessed 5 May 2019.

Wikipedia:WikiProject Women in Red. (2019). Wikipedia. https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Women_in_Red. Accessed 5 May 2019.