Young Adults' Credibility Assessment of Wikipedia[1]

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Abstract

Wikipedia, a publicly edited online encyclopedia, is accessed by millions of users for answers to questions from trivial to high-stakes topics like health information. This new type of information resource may pose novel challenges for readers when they evaluate the quality of content, yet very little is known about how Wikipedia readers interpret the material they find on the site. Do people know that anyone can edit the site? And if so, what does this lead them to believe about the reliability of the material they find? This study analyzes the information-seeking behavior of a diverse group of 210 college students as a first step toward addressing these questions. We find that a few students demonstrate in-depth knowledge of the Wikipedia editing process, while most have some understanding of how the site functions and a few lack even the basic knowledge that anyone can edit the site. Although many study participants had been advised by their instructors not to cite Wikipedia articles in their schoolwork, students nonetheless use it in their everyday lives. This paper lays the groundwork for further research to determine the extent of Wikipedia knowledge in the broader population and in additional diverse contexts.

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Introduction

The discovery and spread of the H1N1 or 'swine flu' virus, first observed in Mexico, was a major world news story during the spring of 2009 (Smith *et al.* 2009). Nearly half of the American public (49%) turned to the Web to find information about swine flu (Allen 2009). The second most visited website after users searched for 'swine flu' was Wikipedia, trailing only the Centers for Disease Control, while Wikipedia was the most visited result after users queried the term 'H1N1' on search engines. The content of Wikipedia can be changed rapidly by anyone who visits the site, which means the material on it is often current but not always reliable, particularly for a high-stakes topic like health.[i] We do not know if users were skeptical of the information they found on Wikipedia or if they went beyond Wikipedia pages to explore further resources, but a review of the literature about online credibility assessment suggests that many people 'may have trouble determining how and when to assess the credibility of online information' (Metzger 2005). Young people may have even more difficulty assessing credibility than adults (Agosto 2002; Matthew S. Eastin 2008; Shenton & Dixon 2004). New Web technologies that change rapidly and rely on content supplied by users, such as Wikipedia, may be still more difficult to evaluate than other forms of online content (Sundar 2008). How do Wikipedia's readers think about and use information they obtain from the site? This is the question this project seeks to answer.

Communication scholars have long investigated how the recipient of a message perceives the credibility of the information source, because this judgment may impact the extent to which the reader believes the content (Hovland & Weiss 1951).[2] Aristotle considered source credibility, or ethos, to be one of the most important elements that a listener used to decide whether or not to believe a speaker, and empirical research has largely validated this claim (McCroskey & Young 1981). It is surprising, given the lack of traditional trust cues on the site, that Wikipedia has become so popular. Pages from Wikipedia have come to occupy top search-engine results the source of much of Wikipedia's traffic (Bausch & McGiboney 2008). Accordingly, some of Wikipedia's popularity may result simply from its top position in search engine rakings, rather than the qualities of its content per se (Hargittai *et al.* 2010).[3]

Most research about Wikipedia has focused on evaluating the accuracy of its content (Chesney 2006; Clauson *et al.* 2008; Giles 2005) or the patterns of editing on the site (Bryant *et al.* 2005; Burke & Kraut 2008; Kittur *et al.* 2007; Kittur & Kraut 2008; Ortega *et al.* 2008), with very little research concentrating on users who visit the site but do not edit articles, despite the fact that they make up the biggest portion of the site's visitors. In 2008, Wikipedia had over 684 million visitors less than two per cent of whom were active contributors with many of the contributions being made by a very small fraction of that two per cent (Ortega et al. 2008), suggesting that a tiny portion of annual users edit Wikipedia regularly.[4] Yet the behavior of that latter small group has been the focus of much more scholarly investigation than the average Wikipedia user. Although some work has mentioned the use of Wikipedia by study participants in the context of investigating other questions (The Associated Press & Context-Based Research Group, 2008; Hilligoss & Rieh 2008; Palfrey & Gasser 2008) or while exploring educational efforts (Cummings & Barton 2008; Skiba 2005), little existing research has concentrated on

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[2] Some Wikipedia pages restrict editing to experienced contributors, usually for a brief period of time. To view Wikipedia's current policies for protecting articles, see http://en.wikipedia.org/wiki/Wikipedia:Protection_policy. To view the policies in effect as of this writing see http://en.wikipedia.org/w/index.php?title=Wikipedia:Protection_policy&oldid=299499966

[3] The reasons for Wikipedia's rise in search engine rankings are complex and will not be discussed here.

[4] From the page Wikipedia:About http://en.wikipedia.org/w/index.php?title=Wikipedia:About&oldid=265268506 last accessed 20 Jan 2009

general users explicitly (Lim 2009; Head & Eisenberg 2010). To address this gap in the literature, this study focuses on Wikipedia readers.

Within the vast population of the site's users, we have chosen to focus on college students. We made this selection for two reasons. First, many of today's college students in the United States have had access to the Web since they were quite young. Survey research in the United States shows that parents are more likely to have Internet access than the general population and they generally believe that their children need to know about the Internet to be successful (Allen & Rainie 2002). Studies also show that access alone does not guarantee online skill, which varies considerably even among young adults (Hargittai & Hinnant 2008). However, younger users, who have been online a significant portion of their lives, are more likely to have achieved a basic comfort level with the medium than people in other age groups. Second, students face many responsibilities of adult life for the first time when they start college and their assessment of online credibility may be increasingly consequential as they begin to gain independence from their parents and guardians. Also, as young adults search for information online, for both significant and trivial purposes, they access Wikipedia more than the general population (Rainie & Tancer 2007). Rainie and colleagues (2007) report on a survey that found 46% of U.S. students over 18 reading Wikipedia, compared to 36% of online American adults. It could be that college students are more confident in evaluating and using online information than older users, but research suggests that young people may simply be less concerned about credibility (Agosto 2002; Hirsh 1999; Palfrey & Gasser 2008), thus making them more likely to use information regardless of its quality.

Below, we begin with a brief introduction to wiki technology, which Wikipedia uses, and the socially interactive process of writing content on a wiki. Next we review credibility's role in information seeking, focusing on source credibility online. We then discuss our method and analysis procedures concerning interviews of and observations with a diverse group of 210 college students and what we found regarding their use and understanding of Wikipedia. We conclude by discussing the wider relevance of the study beyond college students and provide suggestions for future research.

Introduction to Wikipedia technology and related social practices

A Web-based technology called a wiki – the Hawaiian word for quick – allows any visitor to make changes to a Web page simply by clicking an edit button (Cunningham 2005).[5] When saved, these changes are made public instantly. This allows multiple, possibly anonymous authors, regardless of their geographical proximity, to write and edit Web pages together. Wiki technology was invented by computer programmer Ward Cunningham and used primarily by groups of programmers beginning in 1995 (Cummings 2008). Wikis were little known to the general public until the online encyclopedia Wikipedia began to gain wide popularity. The site's traffic grew 8,000% from April 2003 to April 2008 and became one of the top ten websites accessed in the world (Bausch & McGiboney 2008; Rainie & Tancer 2007). Many other Web pages tend to have an identifiable individual or institutional author. On wikis like Wikipedia, however, an author may be listed only as an Internet protocol (IP) address or username, which is often difficult to associate with an individual.

Not only can anyone edit Wikipedia, but editors also engage in a social process whereby they communicate, disagree, and often come to a consensus on the discussion page – also called the 'talk page' – that is associated with each Wikipedia article (Viégas *et al.* 2007).[6] Beyond the discussion page there are policies and guidelines, developed by Wikipedia editors, about who and what is notable

[5] Some wikis require users to register or seek approval from the wiki owner before editing.

[6] Wikipedia does have policies that temporarily restrict editing of certain disputed pages and/or confine editing of the home page to certain users.

enough to merit a Wikipedia page, how information must be cited, what constitutes a neutral point of view and much more. Ignoring these policies can result in deletion of one's contribution.[7]

Media scholar Henry Jenkins has argued (2007) that Wikipedia identifying itself as 'the free encyclopedia that anyone can edit,' may obscure some important aspects of what Wikipedia is:

> *Describing it as an encyclopedia emphasizes Wikipedia as a product rather than focusing attention on the ongoing process by which its community pools information, debates what knowledge matters, and vets competing truth claims (2007).*

Jenkins (2007) does not argue for another metaphor, but he urges those who teach new media literacy to encourage students 'to move beyond the top level and see what's going on underneath the hood'; that is, examine the discussion and history of the article. All of this knowledge is specific to assessing the credibility of a wiki page, which is more complex than many other online sources (Harris, 2008, p. 163).

Information seeking, credibility, and online sources

To define credibility, several researchers equate credibility and believability (Johnson & Kaye 2002; Tseng & Fogg 1999; Wathen & Burkell 2002). Others prefer to explain credibility by distinguishing it from similar concepts such as authority, trust and persuasion (Rieh & Danielson 2007). In this paper we see credibility as believability because this provides an operational definition of trust in an information-seeking context, information that the respondent believes.

Credibility is an important factor in information seekers' decision to use material they have found (Metzger 2005; Rieh 2002). The need for reliable information varies based on context. In a situation where time is limited or the stakes are low (such as a search for the name of a television actor), the most easily available resource is often preferable. The perceived importance of the topic to the evaluator (motivation) is key to the heuristic-systematic model (HSM) of information processing (Chen *et al.* 1999). This model predicts when people will be more likely to make evaluations of information based on its content (systematic processing) versus a shortcut (heuristic processing). The choice depends on the balance between evaluators' desired level of confidence in their judgment, and their actual confidence. 'Perceivers will exert cognitive effort until their level of actual confidence [… closes] the gap between actual and desired levels of confidence' (Chen & Chaiken 1999, p. p. 74). Since systematic processing takes more cognitive effort, heuristic processing tends to prevail.

The source of a message is its originator. But who or what the sender *is* is an open question because scholars have operationalized this concept in various ways (Sundar & Nass 2001). There are two ways to go about defining source; as a psychological concept or as an ontological one. Following the psychological route, the source is whatever the receiver thinks the source is. In the case of Wikipedia it might be that the source is 'anyone' (that is, anonymous or pseudonymous Wikipedia editors) and the medium is Wikipedia, or perhaps Google is thought of as the source because it provides Wikipedia articles as search results and the Internet is the medium (Hargittai *et al*. 2010). Ontological definitions of credibility are numerous. One such definition is based on the domain of the Web: (1) message credibility (i.e., the perceived credibility of the information residing on a Web site); (2) sponsor credibility (i.e., the perceived trustworthiness of the individual whose site is represented); and (3) site credibility (i.e., the perceived reliability of the Web site as a whole) (Flanagin & Metzger 2003). It may be that message credibility takes on special importance on Wikipedia where sponsor credibility and site credibility could be low.

[7] See http://en.wikipedia.org/w/index.php?title=Wikipedia:List_of_policies&oldid=290289363 last accessed 18 May 2009

For some Wikipedia users, site credibility may be artificially high (or at least lack appropriate skepticism) because the user is not aware that Wikipedia articles can be changed by anyone. Rieh and Danielson (2007) note that 'the absence of evidence regarding credibility does not in itself necessarily hinder the assessment of information quality' (p. 32). While Wikipedia articles can stand for evaluation based on their content (systematic processing in the HSM), those who lack the skills to investigate this information or do not know when to be skeptical are more vulnerable to believing misinformation if they rely on heuristics that are not appropriate to evaluate wikis (Hargittai 2007).

Research suggests that young adults may lack basic credibility evaluation skills. A recent two-year study of undergraduate information seeking strategies (on and offline) found that the participants, who were all information management majors, relied heavily on strategies typical of children and high school students throughout the study, only moving beyond them when forced (Warwick *et al.* 2009). The students who did learn new search techniques used them strategically, trying to find the greatest cognitive economy with which they could complete the task at hand. This comports with findings from a survey of college students about their use of Wikipedia, where the results suggest that Wikipedia satisfies users, even though they are unsure about its information quality (Lim 2009). Also, researchers conducted an experiment to assess high school and college students' use of offline source information, which included the author, date and document type, based on six documents from different print sources, such as autobiographies, histories, and novels (Britt & Aglinskas 2002). The students were asked to provide facts to support an argument and, although the college undergraduates generally outperformed the high school students, 41 per cent provided facts that were only described in a source that was clearly identified as a novel, while 32 per cent of the high school students did so. In general high school and college students performed poorly, averaging 15 and 23 per cent respectively on the source comprehension post-test. This suggests that credibility evaluation is difficult for many young adults on and offline.

The content of Wikipedia is constructed through a complex and ongoing social process. This has an unknown impact on the credibility judgments of Wikipedia readers. People seek online information that could be consequential to their life choices, but some users may lack the skills to evaluate effectively complex online materials such as Wikipedia, which lacks a clear analogy to offline media because it is in a state of perpetual revision. Health information-seeking is a robust area of research for this reason (M. S. Eastin 2001; Witteman *et al.* 2007). We focus on college students as a particularly relevant population for reasons described above. We investigate the following research questions:

> RQ: To what extent are college students aware of the way Wikipedia content is created, from the basic fact that anyone can edit Wikipedia to the social processes involved in editing practices?
>
> > RQ A: What does students' extent of awareness lead them to believe about the credibility of information on Wikipedia?

Methods

Data collection

We chose to use in-person observations combined with interviews during and after the observation to investigate our research questions. Observation of information-seeking behavior offers more reliable data than self-reported measures alone, because researchers have found serious discrepancies between what people say they do or should do to evaluate the credibility of online content and what they are observed to do in the few studies that have compared measures on both (Flanagin & Metzger 2007; Hargittai *et al*. 2010).

We asked respondents to come to an on-campus location where the researchers provided a computer with Internet access for students to use during the session. This computer had software installed that captured a video of the screen as the informant performed 12-15 information-seeking tasks. The tasks were designed to investigate several Web-use skills, including credibility assessment. These task topics ranged from seeking health information (e.g., emergency contraception) to job-related content (e.g., advice on resumes) and finding various maps and diagrams (see the Appendix for a complete list of tasks).

Research assistants, including the first author, were trained as interviewers and administered the sessions. Participants were encouraged to talk about what they were doing as they engaged with the tasks (Fonteyn 1993), and interviewers asked for more information about respondent answers as needed, including follow-up questions at the conclusion of the full session. We will refer to this method as task observation interviews. At no point during the sessions were participants prompted to visit Wikipedia nor did we ask questions about the site before the respondents themselves decided to access it. This allowed us to examine Wikipedia use in the context of respondents' regular information-seeking habits. The task observation interview provided the researchers with students' discourse about Wikipedia as well as detailed behavioral data on how they preformed various information-seeking tasks. The interviews were not designed to assess knowledge of Wikipedia systematically, however, many participants offered this knowledge during the interviews and interviewers often probed for this information explicitly once participants had accessed the site. Thus while we have a record of students' Wikipedia use during the sessions through behavioral data, our knowledge of students understanding of Wikipedia is partial.

The data used in this study were collected as part of a longitudinal multi-method project that examined a diverse group of college students' Web-use skills. Task observation interview respondents were selected from the population of first-year students at two universities, one a public university located in an urban area, the other a private university in a suburban area. We will refer to the former by the pseudonym University A (UA) and the latter as University B (UB). The second author of this paper, who designed the study, has never been affiliated with UA and chose this research site because of its diverse student body. Students from UA were chosen from a stratified random sample on skill and gender of those students who had completed a paper/pencil survey administered in 2007 to the population of first-year students in the one required course on the UA campus thereby ensuring full representativeness of the first-year class (survey methods are further described in Hargittai & Walejko 2008). The goal for the task observation interview sample was to have participants with different levels of online abilities represented given that level of skill may affect how users select and evaluate online materials (Fogg 2003). We also deemed it important to balance the gender composition of the sample, because previous work has found gender to be an important predictor of differentiated Internet usage and skill in particular (Hargittai & Shafer 2006). We used survey measures to assess online know-how to ensure representation of students with different abilities (Hargittai 2005, 2009).

We completed 102 task observation interviews with students from the public university, UA, representing a 53% response rate. This group was demographically similar to the sample of the original larger survey study. Participants were offered $40 for their participation in the 90-minute session that included an additional survey and the task observation interview. One year later, these same students were contacted for a follow-up session, for which they were offered $50. Of the 102 students, 75 agreed to take part in the follow-up session for a 74% response rate. During the year in between the two sessions, half of the group was randomly assigned to a one-hour training intervention about Web usage administered by the second author. The purpose of this session was to address areas where students often lack know-how based on the first round of task observation interviews. Part of the training session

included a demonstration of how Wikipedia can be edited by anyone. Just about half (36) of the respondents in the second-wave of task observation interviews participated in the training intervention.

The students at the private university, UB, were chosen from a simple random sample of first-years provided by the university's Registrar's Office. We contacted 185 first-year students, 108 of whom agreed to participate for a response rate of 59%. These response rates are considerably high given the amount of engagement we requested from respondents and are in line with the few studies in the literature that attempt random sampling for such methods (Hargittai & Shafer 2006).

In sum, a total of 210 students completed 285 task observation interviews from March 2007 to May 2008. The interviews lasted just over one hour on average. The 226 hours of interviews were transcribed (including over one million words) and form the basis of our analyses.

Coding behavior and discourse

We compiled a record of respondents' visits to Wikipedia. We also compiled the Wikipedia-related discourse from the text of the interview transcripts. We used both qualitative and quantitative methods for coding this material and to identify the salient categories we knew from previous research, and also to discover the themes present in this rich data set. We began by noting whether or not each student had accessed Wikipedia and which Wikipedia pages they had viewed. Since the type of task (Metzger 2005; Rieh 2002) and the way the site is accessed may affect credibility judgments (Hargittai *et al.* 2010), we also observed the task context, and how Wikipedia was accessed in each particular case. These methods included typing wikipedia.org into the browser, searching for Wikipedia, or clicking on a search result that led to a Wikipedia entry. To see if Wikipedia was a primary information resource for students when faced with a task, we also noted if Wikipedia was the first site that a student accessed, or if it was used later in the search process.

To assess credibility judgment, we evaluated the extent to which a user relied on the information provided by the site. We coded whether or not the student answered the question in the task using information from Wikipedia. Students might judge the credibility of a Wikipedia article by comparing the information with other sites, either those listed as references in the article itself, or other resources. This was also indicated in our coding scheme.

We coded the respondents' statements about Wikipedia using an inductive process. We started with open coding to identify categories of ideas that students expressed when talking about Wikipedia by going through the text in detail, adding codes as needed. Next we proceeded to focused coding where we distinguished the core concerns of the analysis by grouping these categories into thematic units (Emerson *et al.* 1995). This coding scheme was the basis of the themes explored below.

The sample

The students who participated in our task observation interviews were quite diverse in race and ethnicity, with 43.1% non-White participants overall. Table 2 shows, however, that most of this diversity came from the student population of the public university in our study. Another difference between participants from the two campuses was that the majority (68.8%) of those at the private institution, had at least one parent with a graduate degree, while only 10.8% at the other school did so. Despite the differences in demographic background characteristics, the students at both universities exhibit similar basic experiences with the Internet. They all started to use the medium an average of over six years prior to their first year of college, and they used the Web several hours a week at the time of the study (see Table 3).

Accessing Wikipedia

The majority (77%) of our participants accessed Wikipedia during at least one of their sessions. Students accessed Wikipedia in two different ways. Some sought information from Wikipedia directly. These students often typed 'wikipedia.org' into the Web browser's address bar, or they used a search engine to find the Wikipedia home page by using the search term 'Wikipedia.' We will refer to this method as *direct access*. The other method of access occurred when students viewed information from Wikipedia during their use of a search engine such as Google, without specifically seeking information from Wikipedia until they selected a Wikipedia entry from the list of search results. These students entered substantive queries into general search engines about the topic of the task and accessed a Wikipedia article by clicking on the corresponding search result. We will refer to this method as *search access*.

Of the 162 students who accessed Wikipedia at any point during their task session, 47 per cent did so through search engines only, 19 per cent went to Wikipedia directly only, while the remaining 34 per cent accessed the site using both methods. Since students often turn to search engines like Google and Yahoo! for many of their queries, going directly to a resource like Wikipedia may indicate prior knowledge or expectations of what information is likely to be found on it, particularly if the participant turns to Wikipedia as a first strategy when faced with a new task. Students who accessed Wikipedia directly were more likely to visit Wikipedia during more tasks than students who only accessed it through search engine results. Participants who began at least one task by turning to Wikipedia used it during nearly two more tasks, on average, than those who never started a task in this way (see Table 4).

Students who accessed Wikipedia directly tended to express more positive opinions of the site's usefulness and accuracy in the interviews, compared to those who accessed the site via search only or did not access the site at all. However, a significant portion of students who directly accessed Wikipedia expressed misgivings about the site's credibility. Generally these students would turn to Wikipedia during a task they found particularly difficult. A female social science student tried to complete a task using a general-purpose search engine. She explored the results, but then indicated that she was not having success by saying, 'I hate using Wikipedia, but I might as well.' She proceeded to type in Wikipedia's URL, www.wikipedia.org, and searched in Wikipedia. This task was extremely complex, and she decided to quit searching after four and a half minutes without success. Later, the researcher asked this student if she uses Wikipedia, and she said that 'everyone uses it' although was not a 'legitimate' resource, particularly for coursework. She did find the site useful in certain circumstances, however, saying, 'If I'm confused about something… [like the philosophical term] "the categorical imperative" … it would be spelled out in a few sentences.'

A male student from UA who was interviewed twice, one year apart, expressed misgivings about using Wikipedia in both interviews, saying in the first interview, 'Wikipedia … it's not very reliable,' and in the second interview, 'I could try Wikipedia but I don't really trust it.' In each case he was facing a question that ended with him telling the researcher that he could not find the answer after several minutes of searching. When asked why he did not trust Wikipedia this student said, 'I can just go in there and write whatever I want,' but he added that he could verify the information with other websites. The knowledge that anyone can edit Wikipedia was not universal among the students in this study. Below we discuss what students knew about the site and how they learned this information.

Knowledge about how Wikipedia works

The participants varied widely in their knowledge of Wikipedia's editing technology and norms. A math/engineering major from the public university went to Wikipedia directly, and accessed the site during seven of the fourteen information-seeking tasks during his second task observation interview.

The researcher asked this respondent whether he knew how Wikipedia works and got the following reply:

> *Wikipedia, I don't know if a normal person like me is allowed to edit it, but people are hired, and they edit, like, scholars, people that were expert in the technology, or in the issue.*

This student was not a new user of the site; he had accessed Wikipedia during his task session one year prior to the time when he gave this response and noted that he had been using Wikipedia for a 'long time.' He did not mention where he learned this information about Wikipedia. He was not part of the training intervention group so he would not have had the opportunity to learn about the site through that session.

Most students who mentioned Wikipedia knew that anyone could edit the site, and two had even mentioned making small changes to articles themselves. When students recalled learning about Wikipedia's open contribution policy they tended to remember receiving information from educators such as high school teachers, college professors or librarians, rather than from online sources, family or friends. A portion of the participants (17%) also received information about Wikipedia during the training session conducted as part of this research project. We will consider the implications of the training for these students later in the discussion.

Except for the students who took part in the training intervention, we do not know what respondents have heard from other sources about Wikipedia. Rather, we have the students' recollection or impression of the information. Some students recalled instructors having negative reactions to the site. A male computer science student from the private suburban university UB simply stated, '[s]ince Wikipedia theoretically enables everyone to edit, teachers hate it.' This student was a very frequent user of Wikipedia, so much so that he felt Wikipedia was his main source of current events information because he browsed the home page habitually. He had a different opinion of Wikipedia than he ascribed to his teachers.

> *Since Wikipedia can theoretically be entirely wrong, [teachers are] like, you can't use Wikipedia for anything of value. But what's cool about Wikipedia is that, for some reason, people have enough time on their hands that when they put something on there a lot of the times they will cite the source, so you can just go to thir source, which is I guess more reputable than Wikipedia itself. So then you get your information from there. So I just use Wikipedia as a tool when I research stuff. I just can't cite it specifically.*

This student did use Wikipedia as background material during four tasks, and verified the information he found there in the one case where it was directly relevant to the task. He was very successful at the tasks overall.

Several participants expressed doubts about the claims of their teachers based on their own experiences using Wikipedia. A male math/engineering student reported,

> *I haven't come across any totally false facts on it…I mean, I know it's not a reliable website, all your professors tell you, but I use it whenever I need to find something quick [sic].*

This student accessed Wikipedia during three tasks, and consistent with this comment, he found information from a 'more credible' website for a task that asked for information for a class assignment, saying that 'I know teachers like to have a site that's totally credible,' but did not find outside information for the two other tasks.

The fact that 'anyone can edit' Wikipedia was often mentioned as a negative aspect of the site, but for many students, their own experiences reading material on it indicated that it was not a disorganized free-for-all. A male business major stated 'anybody could technically go in there and edit

and put whatever they want' but he immediately added, 'I mean they're doing a good job of keeping it truthful.' A few students mentioned that a consequence of anyone editing Wikipedia is that errors might be corrected. A male social science major noted, 'it gets updated, so people usually fix it.' Only a few students offered any reason why certain information on Wikipedia might be more or less reliable. A female arts/humanities student trusted Wikipedia for certain types of 'obscure' subjects more than others, as reflected in the following exchange.

> *Respondent: Wikipedia is a very stigmatized word. Everyone's like, 'well, anyone can go in and edit it.' But the thing that people don't realize is that no one's going to go in and edit the more obscure articles, except the people that actually know what they're talking about.*
>
> *Researcher: Like teeth diagrams [laughter].*
>
> *Respondent: Yeah, I mean, you know, with all the wrong names.*

This student also said that she would not trust Wikipedia for (in her words) 'hot button issues'. A female architecture major also made this distinction when she was searching for information about Martin Luther King, Jr. Asked why she did not visit Wikipedia during this task she said:

> *It's slightly related, obviously, to race issues so when anything is even remotely sensitive on Wikipedia, the more sensitive it is, the less reliable the article is probably going to be.*

These two students were among the very few who said that the level of controversy or sensitivity of the article topic played a role in their decision about whether to trust information from Wikipedia or not. A more typical comment came from a male communication major who said: 'I know that certain things are prominent enough that it's always being checked and updated, like Martin Luther King.'

Many participants said that they would or should verify the information they found on the site, but few actually did so during the sessions. Of the 162 students who accessed Wikipedia during their task completions, 57 per cent (92 students) used information from it to answer at least one task. Among these 92 students, only about a quarter verified the content obtained from the site, usually by clicking on the references and occasionally by returning to a search engine to query the information. This percentage by itself may not indicate undue reliance on Wikipedia since students may have verified the highest stakes or more controversial topics. However, when we break down the verification activity by task we find that the tasks where students were likely to search for images (determining the likely gender of a name or finding a map of Darwin's voyage around the globe) were checked most often, not the health or controversy-related tasks, suggesting that verification behavior had little to do with the seriousness of the task's implications.

Although most students seemed to have known the most essential fact about Wikipedia's content origins – that it comes from other regular Internet users like them – many lacked more detailed information about how the site works. None of the students made any references to Wikipedia policies and editing principals, such as the importance of neutral point of view or verifiability. The respondents also never mentioned discussion pages or an article's history page as ways to investigate the credibility of content on the site. There was no mention of the concept of Wikipedia editors who are not anonymous but have a documented editing history. Given their lack of mention, there is a good chance that these concepts are not familiar to our respondents.

The students who attended the training intervention were equally likely to access Wikipedia during their sessions compared to the non-training group and there was no statistically significant difference in how often these students verified the information they used from Wikipedia. During the interview, however, members of the group that received training seemed more likely to state their

knowledge about anyone having the ability to edit Wikipedia. This is an important outcome because ensuring basic knowledge about how Wikipedia is edited is critical to proper understanding and use of the site. It is encouraging to know that one training session of which just a few minutes are spent discussing how Wikipedia is edited can have a discernable impression on users of the site regarding some basic aspects of its inner workings.

Information credibility discussion

Most students showed some level of concern about the reliability of content, at least in some circumstances, although a few students professed their lack of interest in the reliability of information in general. After a male business major who accessed Wikipedia during two tasks said that he used Wikipedia 'a lot… for, like, everything' the following exchange took place between this student and the researcher.

Researcher: Are you concerned about reliability and credibility of information?

Respondent: Not at all.

Researcher: Not on Wikipedia, or not in general?

Respondent: Both, really. [...] I should be. I'm not saying it's a good thing, but I know myself. Like right now I'm like, writing a paper and I'm using a lot of information from Wikipedia directly without sourcing it but I'm kind of hoping that it's all good.

Students were aware of teachers' requirements regarding the credibility of resources for class assignments, but several students said that they were not concerned with trustworthiness beyond meeting these requirements. A female social science-sciences double major said, with regard to fact-checking: '[teachers] enforce that on us.' When asked about her concern regarding the credibility of information a female math/engineering major stated:

Only when it's for projects for school or something. Then I'll check to see how reliable and what source it's from or whatever, but normally not really.

Several students mentioned that they should verify the information they get from Wikipedia with other sources. A female arts/humanities and health sciences double major noted:

I've heard that anyone can post information there and not all the information can be accurate... so as long as I could find other information that verifies that information then I think it's fine.

This student used some material from Wikipedia in her answers to two tasks, but did not verify either using other sources.

Considering the use of Wikipedia during health information-seeking tasks is particularly important because it sheds light on significant credibility judgments outside of an educational context, and some students limited their skepticism of Wikipedia to class assignments. Students are likely to be affected by the perceived credibility judgments of others (e.g. educators), rather than their own evaluation of material during education-related tasks. Thus a health information-seeking task provides particularly valuable insights. We asked respondents the following health-related question:

You are at home in the middle of summer. A friend calls you frantically on Friday at midnight. The condom broke while she was with her boyfriend. What can she do to prevent pregnancy? Remember neither of you is on campus and she lives in South Bend, Indiana.[8]

The best answer to this question is to direct the person to a 24-hour pharmacy to ask for emergency contraception that is available over the counter without a perscription, although there are several other answers that may help the hypothetical friend in need. Seven per cent of respondents (14 students) visited Wikipedia during this task. While this percentage may seem low, it was higher than the task with the median number of Wikipedia accesses, which came out to six per cent of respondents. Five additional participants visited a site called 'wiki after dark' that contains, according to the site, 'reader contributed "how-to" articles dealing with all aspects of sex,' which highlights the importance of general knowledge about wikis beyond Wikipedia. While seven respondents found Wikipedia in the course of searching for a response to the above question, seven sought out information from the site directly. The Wikipedia articles the students accessed included 'Condom,' 'Plan B,' 'Emergency Contraceptives,' and 'Parenthood.' Two students clicked on external links from the Wikipedia articles. One participant went to Planned Parenthood and another went to a PubMed record that contained the abstract of a journal article about contraception. Both of these external resources may be credible, but only the student who visited the PubMed record verified information from Wikipedia. In contrast, the Planned Parenthood visitor was seeking additional information, rather than material to corroborate the information she had already found. Of the seven respondents who used at least part of the information they found on Wikipedia in their final answer to the question, all correctly directed the friend to a local pharmacy, although one arts/humanities major was not sure if Plan B would be available to his friend.

The information on Wikipedia that was relevant to the task was correct and did not mislead the students who relied on it, but only one student took any action to verify the information he had found on the site. It is potentially troubling that some students will put more effort into verifying information for school papers than for health-related matters.

Processing Wikipedia articles

Viewing these results through the lens of the heuristic-systematic model (HSM) of information processing (Chen et al. 1999), we see that heuristic processing does seem to prevail when students process information from Wikipedia. Only twenty three percent of students who relied on Wikipedia to answer a task verified the information they found there with other websites, a recommended method of systematic processing. Students stated their general heuristic of trust, mistrust, or defined circumstances for trusting or mistrusting the site. The circumstances they mentioned were usually whether the information was for themselves or for a class assignment. Sometimes participants referenced the importance of information accuracy for the task they were performing as a way to decide whether to trust Wikipedia, and on occasion, they mentioned the controversial status or popularity the topic. Many students do seem to understand that Wikipedia should be used as a starting point rather than an endpoint for research projects. Some understood this in a very limited way as a rule to follow for class that does not apply to real life information seeking. Other students took this warning about information quality on Wikipedia more seriously and formed a generalized mistrust of the site.

[8] Pretesting of the question suggested that this level of detail would be helpful for this question. First, the question concerns a third party so that no personal choices or preferences on behalf of the respondent in such a situation are assumed. Second, timing is the summer late at night so that regular health services on campus are not an option and neither is simply calling a doctor. Third, the location is one where there is no Planned Parenthood so as to elicit responses beyond sending the friend to the local PP facility.

The gullibility error, also called 'blind faith,' occurs when users trust an unreliable source, while the incredulity error is when cynical users mistrust a credible source (Tseng & Fogg 1999). Most interventions focus on avoiding gullibility errors, but preventing incredulity is also important. Like the impractical 'checklist' method of teaching online credibility skills where librarians and educators recommend a rather onerous set of questions for students to answer before accepting an online resource as credible, encouraging students to process information from Wikipedia systematically on all occasions without regard to context may be unrealistic (Meola 2004). This approach could have the unintended consequence of encouraging blind skepticism of an often-useful resource. Educators could instead develop heuristics that can help students assess the content more quickly, such as the level of controversy and visibility of the topic, the presence of citations, and the presence of heated arguments on the 'talk' page.

Limitations

This study is a first step toward better understanding Wikipedia from the users' perspective. Our research methods do not allow us to estimate how many students have certain interpretations or knowledge of Wikipedia. This is an important topic for further research. Also, the task observation interview method may pose some potential challenges for studies of credibility. Participants may view the researcher as an authority figure, like a teacher, and thus be more cautious about the credibility of the websites they visit than they would otherwise be when researching information in their daily life. Alternatively, participants may see the tasks as just artificial assignments and would not care as much about the credibility of the resources they found compared to a real life situation. These two possibilities, however, would influence results in opposite ways and thus may cancel them out. It is also worth nothing that we did observe students making what appeared to be earnest search attempts for each task, in some cases even showing concern for the feelings of their hypothetical friends mentioned in the various task prompts.

Conclusion

Because many Web users have an opportunity to contribute and structure information online, the Web is potentially empowering for individuals and communities (Benkler 2006). Wikipedia is an example of a successful user-generated content project because it has attracted a vast number of contributors and millions of regular readers. The site's success in attracting visitors, some of whom may not be aware of how its content is authored or the implications of this type of authorship, may pose challenges to educators and technology designers who are making efforts to prevent users from falling prey to misinformation.[9] Some current software projects seem to assume that users are aware that anyone can edit a wiki, which should be reconsidered based on this research.

Reliance on Wikipedia for high-stakes information may go far beyond college students. The example of swine flu information-seeking (Allen 2009), mentioned in the introduction of this piece, is a case in point since it shows how prevalent it has become for users in general to turn not only to the Web, but Wikipedia in particular for information about health matters. Another recent incident demonstrates that even professional journalists are vulnerable to misinformation on the site. An undergraduate sociology student in Ireland inserted a false quotation attributed to composer Maurice Jarre on Jarre's entry shortly after his death (Carbery 2009). The student wanted to see how uncited

[9] For example, educators at EDUCAUSE published a guide called "7 Things You Should Know About Wikipedia" available at http://www.educause.edu/ELI/7ThingsYouShouldKnowAboutWikip/161666. Also, there are several software-based projects that aim to inform users about the reliability of wiki content (e.g., Adler & de Alfaro 2007; Suh *et al.* 2008).

information on Wikipedia would diffuse. The quote, which did not have a source attached to it on Wikipedia, was removed within hours, but the student persisted, adding it back to the article three times so that it remained on the entry during the majority of the day after Jarre's death. The false quotation spread through blogs, but also reached newspaper obituaries including that of the *Guardian* (see correction appended to O'Connor 2009). If journalists are using information from Wikipedia without confirming its origins, misinformation on the site may diffuse far beyond the users who happen to be accessing the entry at the time when it contains incorrect information.

Wikipedia readers cannot rely on traditional notions of source credibility, which has always been an imperfect, but useful heuristic (McCroskey & Young 1981). Some of the site's readers have learned of the circumstances and contexts that might lead to unreliable information on Wikipedia (e.g. controversial topics, uncited sources) and how to verify the information if they deem necessary. Readers with this knowledge are able to take advantage of the benefits of Wikipedia while avoiding the risks of being misinformed to a level similar if not superior to those who rely on traditional media gatekeepers. One of the founders of Wikipedia asks us to '[i]magine a world in which every single person on the planet is given free access to the sum of all human knowledge' (Wales quoted in Mangu-Ward 2007, p. Para. 5). Currently, some make more effective use of this access than others. It could be that the basic knowledge that anyone can edit Wikipedia will soon spread, lowering the risk of people being misled easily by misinformation. In the popular television program 30 Rock, a character plays a prank on another by adding false information to a Wikipedia article (Scardino 2009). The inclusion of Wikipedia editing into the plot of a popular TV show is an encouraging sign that basic information about how the site functions will reach wide audiences. Nonetheless, educational initiatives and design changes may be important to ensuring the wide diffusion of knowledge about how Wikipedia works, including information about how to investigate the history and authorship of articles, which does not seem to be widespread even among the young and highly connected population we studied.

Appendix I. Task list administered during in-person observation sessions

Brackets after questions denote samples (explained in the Data Collection section of the paper) that were asked the respective questions.

Comments in brackets were instructions for the Researcher only. 'R' refers to 'respondent'.

Introductory comments by researcher at the beginning of each session:

If you can recall, please bring up the page that is usually on your screen when you start using the Web. That is, the Web site that comes up when you start your Web browser program. [Wait for R to bring up homepage.]

I will now ask you how you would perform various tasks online. Please show me how you would approach these situations. Please note that there is no right way of doing these tasks. We are interested in seeing how you go about finding the following information online.

- (A) Where do you look for information about current events? [UA 07; UB]
  (B) Can you show me the two or three websites that you visit most often? [UA 08]
- Here is a hypothetical. You have a strong opinion about an issue and a friend recommends that you write an email to the chair of the House Judiciary Committee expressing your concerns. Where do you send the message to reach this person? [UA 07; UB]
- You need to read Act 2 Scene 4 from Shakespeare's Romeo and Juliet by tomorrow for class. What is a quick way you can get access to it? [UA 07; UB]
- You are at home in the middle of summer. A friend calls you frantically on Friday at midnight. The condom broke while she was with her boyfriend. What can she do to prevent pregnancy? Remember, neither of you is on campus. She lives in South Bend, Indiana. [UA 07; UA 08; UB]
- (A) A friend of yours is graduating from high school. He has a 2.5 GPA and scored 24 on the ACT. What are the chances that he will get into University of Illinois at Urbana Champaign? [UA 07; UB]
  [Wait until R finishes task]
  (B) .. and how about Columbia College here in Chicago? [UA 07; UB]
- (A) Your cousin is concerned about her health and wants to get an HIV test. She is not a student at any school, but lives here in Chicago. Can you help her find a place to get such a test? Where is the location of such a place and at what times are they open for this service?
  [Wait for R to find a place] [UA 07; UB]
  (B) Let's say you want to go with her. How do you get to this place from [name of school]?
  [Wait for R to approach the question and see if R figures out a method. Then follow up with the next question if R was not using public transportation in that case.] Can you get there using public transportation? How? [UA 07; UB]
- You have to create a poster presentation for class. You're most concerned about how such a document should look and how it can be created with minimal effort on your part concerning the layout. Find help online with your poster layout so that you're ready to go with your own project. [UA 07; UB]
- Does Microsoft Word store information about the author of a document? [Wait for response.] It turns out it does. How can you change the settings in the program so this information is not readily available when the document is shared? [Have R do it.] [UA 07; UB]
  Is it possible to do this so no future documents have the identifying information? That is, change

things so that you don't have to do this on every new document you start? [Wait for R to respond.] It is possible. [UA 07; UB]
Please find out how this can be done. [Don't have R actually do this, just have R find out information about how to do it.] [UA 07; UB]

- You are helping your nephew with his homework. He needs a map of Charles Darwin's voyage around the globe, the entire voyage. Help him get such a map. [UA 07; UB]
- You need to address a letter to the following person and do not know whether this is a man or a woman. The person's first name is Harshini. Can you figure out whether this is likely a man or a woman? [UA 07; UB]
- You are trying to figure out how to write a resume for a summer internship. Find an authoritative source on the subject that helps you identify four key things that need to be on the front page of your resume. [UA 07; UB]
- (A) I heard that in Victorian times, people could carry a special kind of notebook around with them and use it to copy quotations they read and clever sayings they heard. There was a specific name for that kind of notebook, but I've forgotten what it is. Can you tell me?[1]
  (B) You are trying to figure out what two businesses are next door to Brandy Ho's Chinese restaurant in the North Beach neighborhood of San Francisco. What are they? [Hand R a sheet of paper with the name 'Brandy Ho's' so that R knows the spelling] [UA 07; UA 08; UB]
- Let's say you recently saw a presentation about applying to graduate school. You want to see if you can find the presentation slides online. How would you look? [UA 08]
- You heard a story that there is a Michael Jordan out there who teaches statistics at a university. Can you verify this? [UA 08]
- How many countries currently have a woman in the leading political role? [UA 08]
- [Go to the URL of an error page in a website that contains information about research skills on R's Web browser.] You are looking for information about research skills and you end up on this Web site. It is an error. Is there any way you can figure out what may have been on this Web page? [UA 08]
- A friend of yours is thinking about volunteering for the Democratic National Convention this year. She asked you to help her track down information about what it was like for people to volunteer at the 2004 Convention. How would you find such information for her? [UA 08]
- Your tooth hurts and you call your dentist to tell her about it. [Hand R a diagram of the teeth in the human mouth with one tooth highlighted.] This is the tooth. You don't know what it's called. How can you figure it out? [UA 08; UB]
- You are preparing a presentation for class on Martin Luther King Jr. What online resources can help you with this? Your teacher wants at least three sources. What material from the Web might you use? [UA 08]
- Let's pretend that you are trying to figure out where to move next year in the city. You are looking for an area with relatively low levels of crime. You would like to know how Little Italy compares to Roger's Park. How can you figure this out? [UA 08]
- [Hand R an unlabeled picture of the game called tower of Hanoi.] Do you know how to play this game? [Wait for response.] Can you find out? [UA 08]
- You are out and about taking photographs on the street in front of a corporate building. Suddenly a security guard comes and tells you that you are not allowed to take photos there. What do you do? Find some information online about you rights as a photographer. [UA 08]

- You want to teach your cousin how to create interesting digital images. Unfortunately, neither of you has the budget to buy software. Can you name or find three or four free resources that would help you in this activity? [UA 08]

Table 1: Methods, response rates and sample sizes

	Response Rate	Respondents
UA task observation interview 1, stratified random sample from UA survey	53%	102
UA Web skills training session, random sample consisting of half of the task observation interview respondents	71%	36*
UA task observation interview 2, recruited all task observation interview 1 respondents one year after first interview	74%	75*
UB task observation interview, random sample	59%	108
Total respondents		210

* These participants were drawn from the 102 students in UA task observation 1

Table 2: Descriptive statistics about the samples (percentages)

	UA 07 (n=102)	UA 08 (n=75)	UB (n=108)	All students* (n=210)
Women	49.0	46.7	56.9	53.3
Age				
18	69.6	0	63.9	66.7
19	30.4	70.7	35.2	32.9
20	0	29.3	0.9	0.5
Race and ethnicity**				
White, non-Hispanic	42.6	42.5	70.4	56.9
Hispanic	18.8	16.4	3.7	11.0
African-American, non-Hispanic	4.0	5.5	2.8	3.3
Asian-American, non-Hispanic	33.7	34.3	23.2	28.2
Native American, non-Hispanic	1.0	1.4	0.0	0.5
Parent's highest level of education				
Less than high school	6.9	8.0	0.9	3.8
High school	19.6	21.3	2.8	11.0
Some college	23.5	21.3	5.5	14.3
College graduate	39.2	38.7	22.0	30.5
Graduate degree	10.8	10.7	68.8	40.5

* UA students were only counted once, although 75 were interviewed twice. This column combines the UA 07 and UB columns using age data from UA 07.
** One UA student who participated in UA 07 and UA 08 did not provide race and ethnicity information.

Table 3: Respondents' Internet use experiences (mean with standard deviation in parentheses)

	UA 07, n=102	UB, n=108
Number of Internet use years	6.2 (2.0)	6.8 (1.9)
Number of hours on the Web weekly*	17.0 (10.7)	15.6 (8.9)

* This measure only concerns Web use and excludes time spent on email, chat, or VoIP.

Table 4: Wikipedia access frequency by access method

	Percentage of respondents (n=210), number of respondents in parentheses	Average per cent of tasks in which students accessed Wikipedia using various modes
All respondents who accessed Wikipedia	77 (162)	13.9
Search access only	36 (76)	** 9.7
Ever used direct access	40 (86)	** 17.5
Wikipedia as a first strategy (direct or search access)	12 (26)	** 25.1

** t-test comparing the identified category versus all other respondents who accessed Wikipedia significant at the .01 level.

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