

College Students' Credibility Judgments and Heuristics Concerning Wikipedia

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## **Abstract**

This study examined: 1) whether a peripheral cue and subject knowledge influenced the credibility judgments in the context of Wikipedia; and 2) whether certain factors affected heuristic processing in the context of Wikipedia. The theory of bounded rationality and the heuristic-systematic model serve as the basis of this study. Data were collected employing a quasi-experiment and a web survey at a large public university in the Midwestern United States in the fall of 2011. The study participants consisted of undergraduate students from nine courses whose instructors agreed to their participation. A total of 142 students participated in the study, of which a total of 138 surveys were useable. The major findings of this study include the following: a peripheral cue and knowledge influenced the credibility judgments of college students concerning Wikipedia. The effect of a peripheral cue on credibility judgments was not different between those with high versus low knowledge. Finally, perceived credibility was positively related to heuristic processing, but knowledge, cognitive workload or involvement in a topic was not. This study suggests that educators and librarians need to integrate heuristic approaches into their literacy programs, guiding students to effectively use and not blindly accept cues. Wikipedia needs to offer noticeable cues that can help Wikipedia readers assess the credibility of information. The role of perceptions in heuristic processing needs further investigation. Further, this study demonstrates the strength of a peripheral cue on credibility judgments, suggesting that further research is needed when cues lead to effective credibility judgments and when cues lead to biased credibility judgments. Finally, this study provides the suggestion of an integrated model of the theory of bounded rationality and the heuristic-systematic model that can enhance our understanding of heuristics in relation to credibility judgments.

Keywords: credibility; peripheral cue; knowledge; bounded rationality; heuristic-systematic model; heuristic

## **1. Introduction**

Credibility is one of the oldest research topics, originating with the ancient Greeks (Self, 2009). Scholars have paid a great deal of attention to credibility issues in recent years due to the complex characteristics of Web information. The unclear origins and contexts of information, and non-rigorous quality control in the publishing process are a few such characteristics of Web information (Eysenbach, 2008; Flanagin & Metzger, 2008). Furthermore, Web 2.0 technologies, which encourage people to offer their opinions about a particular topic (Hesse et al., 2011) contribute to the proliferation of user-generated content (UGC), thereby making Web information even more complex. UGC can provide useful knowledge through collective intelligence. However, the unfiltered mechanism of UGC opens the possibility for the dissemination of unreliable or biased information (Metzger & Flanagin, 2011).

In contrast to the complexity of Web information, Internet search engines are easy to use, leading people to turn to Web information more than ever before. Pew Internet and American Life Project data (2012) show that as of February 2012, approximately 91% of online adults use search engines to find information on the Web. Similarly, a recent study shows that college students routinely use search engines. However, they have difficulty filtering relevant information from non-relevant information in their search results (Head & Eisenberg, 2011).

This literature implies that it is likely for online users to face challenges in discerning credible from non-credible information in their search results or Web information. As a result, it is necessary to conduct research that can help us understand which factors affect people's credibility judgments and to conduct research that can provide Internet users with some strategies to assess the credibility of information in order to make appropriate information decisions.

Over the past decade, researchers have examined how Web users judge the credibility of information, and why they perceive certain information as being more credible than other. Previous studies have shown that Web users hardly use certain elements of a traditional checklist such as accuracy, authority, author, objectivity, coverage or currency, which are considered to be important in evaluating information (Lackaff & Cheong, 2008; Metzger, 2007). Instead, people tend to take heuristic approaches in employing easily noticed features. For instance, surface features or certain peripheral cues such as professional website design (Fogg et al., 2002) or the attractiveness of images, or structural features, (Reinhard & Sporer, 2010; Rains & Karmikel, 2009 ) influence Web users' information credibility judgments. Some authors attribute the superficial characteristics of users' Web evaluations to the Internet itself. For instance, according to Carr (2010), the Internet promotes scanning and skimming rather than reading, concentrating and contemplating. As a result, Internet users are encouraged to superficially engage in Web contents. In addition, UGC users tend to rely on others' credibility judgments, employing social endorsement cues as a heuristic (Metzger, Flanagin, & Medders, 2010).

Interestingly, the literature shows that humans' use of cues or heuristics in assessing information is not a unique phenomenon of Web information. Namely, prior to the Internet era, human heuristics have long been acknowledged in the social psychology literature. For instance, scholars of bounded rationality have explained human heuristics as efficient cognitive processes requiring less effort (Gigerenzer & Brighton, 2011; Gigerenzer, Hertwig, & Pachur, 2011; Simon, 1955; Todd, 2002). The literature of bounded rationality dates back to Simon's work in the 1950s. In addition, certain dual-process theories such as the elaboration likelihood model (Petty & Wegener, 1999) and the heuristic-systematic model (HSM) or theory of heuristic and systematic information processing (Chaiken & Ledgerwood, 2011; Chen & Chaiken, 1999) pay attention to heuristics that use peripheral cues in the human information process. These models were first developed in the mid-70s (Petty & Brinol, 2011), which indicates that heuristics may be a common phenomenon of human minds in processing information regardless of the newness of Web information. Nonetheless, the theory of bounded rationality and dual-process theories offer different rationales for human heuristics, as described below. Given this literature, it would be useful to examine whether peripheral cues that lead to heuristics affect credibility judgments concerning Wikipedia. In addition, it would be useful to examine whether certain factors influence heuristic processing in the context of Wikipedia, which can offer some explanations as to why people use heuristics. Finally, previous studies have shown that an individual's subject knowledge influences his/her credibility judgments (Braten, Strømsø, & Salmeron, 2011; Liao & Fu, 2011). As one's subject knowledge is important in evaluating the merits of information, it would be useful to find out whether the effect of the peripheral cues on credibility judgments differs, according to the level of one's subject knowledge. Here, *cues* are pieces of information that can lead to an evaluation of the information (Sundar, Xu, & Oeldorf-Hirsch, 2009). *Peripheral cues* refer to the objects or attributes related to a message or a person, but not to the

central merits of a message or person. The term, *heuristics* refers to judgment rules or “mental generalizations of knowledge based on experience” (Sundar et al., p. 4233) that are triggered by cues. In this study, the terms, *heuristic cues* and *peripheral cues* are used interchangeably.

The main purpose of this study is twofold: 1) to examine a peripheral cue, knowledge and the interaction between a peripheral cue and knowledge in credibility judgments concerning Wikipedia; and 2) to understand heuristics by examining whether certain factors are related to heuristic processing concerning Wikipedia. The first part of this study was built on Lim and Simon’s (2011) study, which suggests further re-examination of peripheral cues of Wikipedia in credibility judgments. The main focus of this part of the study centered on finding out the role of peripheral cues that can lead to heuristics and its interaction with subject knowledge (which is substantial in evaluating information) in credibility judgments. The second part of this study attempted to understand why people use heuristics. The heuristic-systematic model served as the basis for exploring this question. In particular, this study examined whether certain factors drawn from HSM (e.g., perceptual, cognitive and motivational factors) affected heuristic processing in the context of Wikipedia. Along the way, the theory of bounded rationality was contrasted with HSM in order to offer different explanations for heuristics, thereby, providing a better understanding of heuristics. By fulfilling these two study purposes, it is hoped that this research contributes to our understandings of the role of peripheral cues in credibility judgments and heuristics. Further, this study aims to provide implications for credibility research and information literacy practices. The major research questions include the following:

RQ1. Does a peripheral cue influence the credibility judgments of Wikipedia?

RQ2, Does one’s subject knowledge influence the credibility judgments of Wikipedia?

RQ3. Does the effect of a peripheral cue on credibility judgments differ according to subject knowledge?

RQ4. Why do people adopt heuristic processing?

The study’s significance lies in the following: first, it provides new knowledge of readers’ credibility judgments in relation to a peripheral cue and subject knowledge concerning Wikipedia. This knowledge enhances our understanding of credibility judgments in relation to heuristics in Web 2.0 environments. Second, it offers potential theoretical implications by suggesting an integrated model of HSM and the theory of bounded rationality, thereby enhancing our understanding of human heuristics regarding UGCs. Finally, this study’s findings can help educators and librarians guide students so that they can take advantage of the effectiveness of heuristics by employing and being aware of the biases of the human mind when using such cues in credibility judgments.

## **2. Literature review**

### *2.1. Relevant theories and applications to this study*

This study employed both the theory of bounded rationality and the heuristic-systematic model (HSM) in order to understand the role of peripheral cues in credibility judgments and to understand why people use heuristics or take shortcuts. The theory of bounded rationality

provides useful insights into people's use of cues in an uncertain environment, which is applicable to credibility judgments concerning user-generated content (UGC), such as Wikipedia. HSM sees that people adopt heuristic processing by using easily noticed cues (e.g., peripheral cues) in evaluating information particularly when they are unable or unmotivated to process information. This subsection discusses the core ideas of each theory regarding heuristics and their applications to this study.

### 2.1.1. *Theory of Bounded Rationality and the Heuristic-Systematic Model on Heuristics*

According to Simon (1997), humans are *boundedly rational* due to the limitations of their cognitive ability, time and resources. In order to cope with the limits of bounded rationality, humans pursue certain mechanisms or strategies, such as heuristics that are compatible with bounded rationality. Humans' adaptability to their environments is another important element of Simon's bounded rationality, which is described as an analogy of two blades of a pair of scissors (Simon, 1990). By using an analogy, Simon explains that human behavior is shaped by both the human mind and the environment.

Scholars of bounded rationality offer further explanations as to why humans use heuristics. For instance, Gigerenzer (2011) discusses the effectiveness of heuristics by describing the two principles of Simon's bounded rationality: "*less-can-be more*" and "*Simon's scissors*" principles. Gigerenzer (2011) stresses that heuristics that ignore part of the available information can lead to better decisions than more complex strategies. In fact, Gigerenzer and Brighton's (2011) empirical data support the *less-can-be more* (or the *less-is-more*) effect, demonstrating that certain heuristics result in better outcomes than complex models. In addition, scholars of bounded rationality pay attention to the environments in which humans are situated. That is, according to Gigerenzer et al. (2011), the effectiveness of heuristics depends on the environment. In a well-defined world, about which Leonard Savage uses the notion of a small world, the accuracy-effort trade-off works. On the other hand, in an uncertain world where not all alternatives and consequences are known, about which Leonard Savage uses the notion of a large world (as cited in Gigerenzer et al., 2011, p. xviii), heuristics can be more accurate than complex strategies, contrary to the common belief of an accuracy-effort trade-off. Furthermore, Simon (1979) argued that optimization is rarely feasible in a large world. As a result, humans need to take a *satisficing* (a blend of *sufficing* and *satisfying*) path rather than an optimal one. Moreover, heuristics can be superior to optimization even when optimization is feasible (Gigerenzer, 2011).

This literature suggests that heuristics are, indeed, efficient cognitive processes and require less information and time. For this reason, Gigerenzer and Brighton (2011) argue that humans can rely on heuristics not because they require less effort, but because they are accurate, thus they use the notion of *homo heuristicus*. In other words, to scholars of bounded rationality, humans are not cognitive misers (Gigerenzer et al., 2011). These explanations of heuristics help us understand why people use heuristics or take shortcuts.

On the other hand, HSM (Chaiken & Ledgerwood, 2011; Chen & Chaiken, 1999) explains heuristics in relation to individual cognitive ability and motivation. That is, when people are motivated and able to assess information, they perform systematic information processing, which requires high cognitive demands for analyzing the merits of a message, using all available

information. This systematic information processing involves “effortful scrutiny.” On the other hand, when people have low motivation and low ability to assess information, they perform heuristic information processing, which requires minimal cognitive demands. This heuristic route involves “effortless” information processing using information cues (e.g., peripheral cues) that can be easily processed. HSM assumes that systematic processing leads to optimal judgments, and a trade-off exists between optimal judgments through systematic processing and efficient judgments through heuristic processing (Chaiken & Ledgerwood, 2011), which is sharply different from the theory of bounded rationality. In this model, humans are seen as cognitive misers, and people use heuristics because they are inclined to minimally exert effort unless they are motivated to do so otherwise (Chaiken & Ledgerwood, 2011; Chen & Chaiken, 1999). HSM implies that people mainly use heuristics because they are unable or unmotivated to process information, despite its recognition of the co-occurrence of systematic and heuristic processing.

### *2.1.2. Applications of the theories to this study*

Both the theory of bounded rationality and the heuristic-systematic model (HSM) imply that peripheral cues can influence human information processing and credibility judgments. A number of empirical studies support this promise, as discussed below. From the perspective of bounded rationality, heuristics generally operate regardless of individual cognitive ability or motivation, and heuristics are effective in an uncertain environment. It seems that heuristics are particularly relevant to Web 2.0 environments, where information is abundant and the quality of the information is uncertain, which fits Savage’s notion of a large world. Therefore, heuristics can be useful to users of UGC. In fact, regarding situations where the origins of the sources are unknown and are heavily layered, Self (2009) points out, which people choose such cues as social endorsement that are meaningful to them. In other words, social endorsement serves as a heuristic cue for evaluating the credibility of UGC. Similarly, Wikipedia readers may use certain peripheral cues (e.g., the length of references) that can help them quickly evaluate the credibility of its information. Such cues can trigger judgments rules which are heuristics (e.g., “An article with a long list of references is more credible than that of a short one”; “If my peers think that Wikipedia is good, it must be good”).

On the other hand, HSM sees that heuristics depend on individual cognitive ability and motivation, and heuristics lead to less optimal decisions than systematic processing. These two different perspectives imply that certain factors related to information processing can lead to different expectations. For instance, subject knowledge that is essential in evaluating the merits of information (systematic processing) may or may not interact with peripheral cues used in heuristic processing. From the perspective of the theory of bounded rationality, it is expected that the effect of peripheral cues do not significantly differ, according to the level of subject knowledge, as heuristics generally operate in human minds. On the other hand, HSM would expect the effect of peripheral cues to differ, as heuristics operate when people are unable or unmotivated to process information. The first set of research questions from RQ1 through RQ3 explores these inquiries, employing a quasi- experiment.

As described above, the theory of bounded rationality explains heuristics as people’s adaptive behavior to their environment. According to Simon (1990), such behavior is shaped by both the human mind and the environment. Nonetheless, it seems that other scholars of bounded

rationality pay little attention to individual differences regarding heuristics, as this group of scholars sees that heuristics generally operate in human minds (*homo heuristicus*). As a result, scholars of bounded rationality are more interested in when (e.g., under what environment) heuristics work and when they do not (Gigerenzer and Brighton, 2011) rather than in individual differences. On the other hand, HSM focuses on individual differences regarding systematic and heuristic processing. As a result, HSM pays attention to the micro (individual) factors of heuristics and is hardly interested in environments. Given the different understanding of these theories, this study explores why people use heuristics (RQ4) by examining whether certain factors drawn from HSM are related to heuristics. The results can provide certain implications for both HSM and the theory of bounded rationality regarding heuristics in relation to individual factors, which described in the next subsection. Furthermore, the discussion section offers the implications of the results.

## 2.2. *The concept of credibility and empirical studies on credibility*

Credibility has been defined by a variety of terms, including believability, reliability, accuracy and truthfulness, trust, and dozens of other concepts (Flanagin & Metzger, 2008; Kim, 2010; Self, 2009; Tormala & Petty, 2004; Tseng & Fogg, 1999). Despite there being no consensus on its definition among scholars, researchers tend to describe credibility as the two dimensions of expertise and trustworthiness (Flanagin & Metzger, 2008; Jensen, 2008; Lim & Simon, 2011; Newhagen & Nass, 1989; Rieh, 2010; Rieh & Danielson, 2007; Tseng & Fogg, 1999; Wang, Walther, Pingree, & Hawkins, 2008; Wathen & Burkell, 2002). The literature shows that Carl Hovland and his colleagues defined credibility as expertise and trustworthiness in the 1950s (as cited in Self, 2009, p. 438), and other researchers have widely adopted this definition since then. Expertise refers to a communicator's qualifications to know the truth on a topic, while trustworthiness refers to a communicator's motivation to tell the truth (Jensen, 2008; Wang et al., 2008). Expertise includes relatively objective characteristics of the source or message while trustworthiness is mainly a subjective matter perceived by a receiver (Flanagin & Metzger, 2008). The two components of expertise and trustworthiness are not always perceived together. Most credible information is perceived to have high levels of expertise and trustworthiness (Rieh, 2010). Nonetheless, the new interactive online media have resulted in situated judgments of credibility (Self, 2009), which, in turn, make credibility ultimately a subjective matter. Based on this literature, I define credibility as an individuals' assessment of whether information is believable, based on his/her knowledge, experience and situation.

Previous studies have shown that certain peripheral cues influence credibility judgments across different media. This evidence indicates that people use heuristics in judging the credibility of information. Fogg et al. (2002) conducted a Web site credibility study and found that Web users did not use rigorous criteria when evaluating the credibility of the Web site. Instead, people paid more attention to superficial aspects of the site such as the overall visual design of the site, including the page layout and color schemes, and such aspects influenced their credibility judgments of the Website. Similarly, Dochterman and Stamp (2010) report that the webpage layout was the second frequently mentioned factor influencing Web credibility judgments. Other researchers have also found that structural features of health Web sites such as images, the navigation menu, third-party endorsements, and the names of organizations operating or sponsoring the Web sites, among other things (Rains & Karmikel, 2009), or the attractiveness

of images (Reinhard & Sporer, 2010), influenced the credibility judgments of participants in their studies. More recently, two studies examined whether a peripheral cue measured as the length of references (Lim & Simon, 2011) ) or the length of references (Lucassen, Noordzij, and Schraagen, 2011) influenced the credibility judgments of Wikipedia information. Lucassen et al. (2011) found a significant relationship between the length of references and credibility judgments, while Lim and Simon (2011) did not. Nonetheless, overall, Lim and Simon's (2011) study is consistent with these findings. In their study, participating college students reported using peripheral cues such as the length of an article, external links and references when they were uncertain about the believability of a Wikipedia article. In addition, with respect to non-Internet contexts, Bracken (2006) found that the image quality of local television news was positively associated with the audience perception of source credibility. Similarly, Hall and his colleagues (2009) reported that political candidates' facial appearance affected voters' decisions. These findings demonstrate that peripheral cues influence credibility judgments. For this study, a list of references was operationalized for a peripheral cue, leading to the following hypotheses:

H1. A peripheral cue has an effect on the credibility judgments of Wikipedia.

H1.1. The more references, the more credible the respondents judge a Wikipedia article.

Previous studies have shown that subject knowledge affects credibility judgments or trust in information. Braten et al. (2011) examined whether knowledge was a factor affecting undergraduate students' trustworthiness judgments of different information sources regarding climate change. They found that students with low topical knowledge tended to trust less trustworthy sources than those with high knowledge. Similarly, Liao and Fu (2011) examined domain knowledge in relation to content and context cues in older adults' credibility judgments of Internet health information. Some of their content cues included ratings by users and professionals, the degree of use of evidence, and the rigor of argument and information quality. Their contextual cues included such features as references, author information, third-party endorsements and site ownership. They found that older adults with high health domain knowledge performed just as well as younger adults in credibility judgments by showing that they were able to differentiate between strong and weak content and context cues, while older adults with low domain knowledge performed more poorly than younger adults and were not able to differentiate such cues. From this literature, two hypotheses were drawn:

H2. Knowledge level has an effect on the credibility judgments of Wikipedia.

H3. The effect of a peripheral cue on credibility judgments differs according to a user's knowledge level.

### 2.3. Factors related to heuristics

As seen above, the theory of bounded rationality and HSM offer different reasons for human heuristics. To the scholars of bounded rationality, humans use heuristics not because they are cognitive misers, but because heuristics are effective (Gigerenzer et al., 2011). Further, from their perspective, human cognitive limitations are not the only reason for using heuristics. In fact, it is one of the biggest misconceptions that people use heuristics only because of cognitive limitations (Gigerenzer & Brighton, 2011), in addition to the misconception that people use



heuristics only for routine decisions of little importance (Gigerenzer, 2008). Instead, heuristics are seen as a common phenomenon of the human mind in the processing of information, regardless of individual cognitive ability or motivation. On the contrary, according to HSM, humans use heuristics because they are generally inclined to minimally exert effort. Given this literature, it would be useful to examine whether cognitive and motivational factors are, indeed, related to heuristic processing concerning Wikipedia. If cognitive and motivational factors are (negatively) related to heuristic processing, HSM will be supported. If this is not the case, then the results would be consistent with explanations of the theory of bounded rationality.

The literature shows that motivation is expressed or measured in terms of personal relevance, involvement, task importance, accountability, need for cognition, cognitive workload or a combination of some of the components (Borah, 2011; Ferran & Watts, 2008; Kang, Bae, Zhang, Shaoke, & Sundar, 2011). By adopting these previous studies, this research measured motivation as the components of involvement and cognitive workload. The methodology section offers further description of these two components of motivation. In addition, this study employed subject knowledge as a surrogate variable of cognitive ability, as knowledge is considered to be the product of cognitive ability (Pritchard, 2010), and enables people to evaluate the merits of information (systematic processing). Therefore, it is expected that people with lower subject knowledge on a topic will be more likely to rely on heuristic processing than those with higher subject knowledge.

In addition, the bias hypothesis of HSM indicates that people tend to evaluate a message from an expert source as more favorably than that from a non-expert source (Chaiken & Ledgerwood, 2011; Chen & Chaiken, 1999). In other words, people's pre-existing perception of a source influence their credibility judgments on the information from that source. Based on this bias hypothesis, some researchers further examined whether people used systematic processing when they were exposed to a distrusted source or a source without a positive heuristic cue (e.g., a non-expert source) rather than to a trusted source or one with a heuristic cue (e.g., an expert source) (Koh & Sundar, 2010; Lucassen et al., 2011; Petty & Brinol, 2008). Lucassen et al. (2011) found that students who had high trust in Wikipedia tended to use heuristics, while students who had low trust in Wikipedia tended to adopt systematic processing. Koh and Sundar's (2010) data supported their hypothesis under a high Type I error ( $p < 0.07$ ). These studies indicate that the perceived credibility of Wikipedia (as a source cue of Wikipedia) may be related to heuristic processing. This literature led to the following hypotheses.

H 4. Cognitive workload, involvement in a topic, subject knowledge and perceived credibility are related to heuristic processing.

H4.1. Cognitive workload is related to heuristic processing.

H4.2. Involvement in a topic is related to heuristic processing.

H4.3. Subject knowledge is related to heuristic processing.

H4.4. Perceived credibility is related to heuristic processing.

### **3. Methodology**

### 3.1. *Participants*

The data were collected at a large public university in the Midwestern United States in the fall of 2011. The population of the study was all undergraduate students at the university. The study participants consisted of undergraduate students from nine courses whose instructors agreed to their participation. The courses comprised a wide range of disciplinary areas, including history, art history, astronomy, economics, biology, legal studies, religious studies, gender studies, and information studies. None of courses dealt with environmental issues or Wikipedia. It might be possible that Wikipedia could be discussed in the information studies course, although Wikipedia was not included as a course topic or course material in the syllabus in the information studies course. Due to this reason, there was an analysis conducted to see whether any differences existed between the data from the information studies and those from the other courses regarding credibility judgments and the perceived credibility of Wikipedia. Results showed that there were no differences in terms of credibility judgments or perceived credibility. This evidence indicates that the information studies course did not influence the results of this study. Approximately 2,090 students were invited to participate in the study and a total of 142 students participated, resulting in a response rate of 6.8%. Four surveys from the information studies course (that were completed after a student's class blog post on this study around the survey closing time) were removed, leaving a total of 138 surveys for the analysis. A total of 122 (completed surveys) to 138 (completed the experiment only) surveys were usable. One group of students from a course received extra credit as compensation for participation. The other group of students from other courses had the opportunity to enter a random drawing to win a prize of a \$30 gift card as compensation for participation. A total of 87 students were compensated by either receiving extra credit (37 students) or winning a gift card (50 students).

### 3.2. *Data collection methods: A quasi-experiment and a survey*

This study employed both a quasi-experiment and a web survey regarding students' credibility judgments of Wikipedia. The quasi-experiment was embedded in the survey.

#### 3.2.1. *The design of the quasi-experiment*

The experiment took the form of a 2x2 factorial design, with a peripheral cue of a Wikipedia article (high or low number of references) and knowledge (high or low knowledge). One independent variable of the peripheral cue was manipulated by creating two different screens with a high or low number of references and each condition was randomly assigned to the participants. On the other hand, the independent variable of knowledge was measured and divided into two categories (high or low knowledge), based on the mean value of the total score of the measurements of knowledge from the survey. In other words, one independent variable was manipulated and the other independent variable was not, which led to a quasi-experiment.

#### 3.2.2. *Selection and modifications of the Wikipedia article*

A Wikipedia article, titled, "Environmental impact of meat production," was selected (at [http://en.wikipedia.org/wiki/Environmental\\_effects\\_of\\_meat\\_production](http://en.wikipedia.org/wiki/Environmental_effects_of_meat_production)). As of April 10, 2011, the version of March 16, 2011 was the latest version of the article, which was used as the basis for creating the screens of the experiment of the variable of the peripheral cue. The criteria for the selection of the article were as follows: 1) The topic is controversial enough to raise

questions about credibility, which is suggested by previous studies (Hu & Sundar, 2010). 2) An article should have a sufficient text about the topic of the study, but should not be too long so as not to overwhelm participants in completely reading the article and survey, which led to the selection of a C-Class quality article, as rated by the Wikipedia Editorial Team. 3) The Wikipedia Editorial Team defines a C-Class quality article as an article that “is substantial, but is still missing important content or contains a lot of irrelevant material. The article should have references to reliable sources, but may still have significant issues or require substantial cleanup” (Wikipedia:Version 1.0 Editorial Team/Assessment, 2011). According to the team, this class of articles is useful to a casual reader, but would not offer the whole picture for even a moderately detailed study (Wikipedia:Version 1.0 Editorial Team/Assessment, 2011). Finally 4) the original article had a warning message and an image. These objects were removed from this study to determine the effect of the length of references on credibility judgments and to eliminate any possible effects of such objects.

### 3.2.3. Procedure

The participants were directed to the study’s website via a written URL included in the solicitation email. They were told that they could access the site from any computer with access to the Internet, at their convenience, for approximately three weeks at the early stage of fall semester. In the study site, the participants were asked to read a consent form, prior to their participation in the study. The consent form described the standard protocols of research involving human subjects. In addition, the participants were told that they would be asked to judge the credibility of a Wikipedia article that they would be viewing. After giving their informed consent online, the participants were asked to respond to a set of questions about their knowledge of the topic of the article. Then, the participants were randomly assigned to one of the two screens of Wikipedia (high or low references) by a computerized program. The participants would view one of the following versions:

Version 1: A Wikipedia article with a higher number of references (a total of 22 references) (N=77)

Version 2: A Wikipedia article with a lower number of references (a total of 1 reference) (N=61)

They were instructed to read the article they were viewing. Then all participants were directed to a questionnaire that they would complete online. Once directed to the questionnaire, the participants were not able to view the article again.

### 3.2.4. The survey instrument

All variables were rated on a 7-point scale with the anchors “strongly disagree” and “strongly agree,” unless otherwise noted. Table 1 presents the major variables of this study. *Credibility* was defined as an individuals’ assessment of whether information is believable based on his/her knowledge, experience and situation. The seven items regarding credibility were developed or modified based on the literature of credibility (Cassidy, 2007; Gaziano & McGrath, 1986; Hilligoss & Rieh, 2008; Lim, 2009; Lim & Simon, 2011; Meyer, 1988; Tseng & Fogg, 1999; Tsfati & Cappella, 2005). This concept of credibility was examined in two ways: credibility of the article that the participants viewed (credibility judgments) and perceived credibility of the Wikipedia articles, overall, by the participating students (perceived credibility).

*Peripheral cue* was defined as an object or attribute related to the content of a text, but not the central merits of the text. For the experiment, the peripheral cue was measured by the length of references. *Knowledge* was measured by directly asking whether the respondents had knowledge of the topic of the environmental impact of meat production, using two items. *Motivation* was measured through two dimensions of *cognitive workload* and *involvement*. In fact, this study developed the measurements of one concept of motivation encompassing involvement and cognitive workload. A factor analysis resulted in two dimensions of this concept, leading to an analysis of two separate variables. *Cognitive workload* was defined as the degree of difficulty in paying attention to a task. Five items were modified from the measurements of previous studies (Borah, 2011; Ferran & Watts, 2008). *Involvement* was defined as the degree of relevance and interest in the topic of an article. The measurements were developed based on a study by Ferran and Watts (2008). *Heuristic processing* was defined as quick information processing in obtaining and judging the quality of the contents or objects, employing a cue or shortcut that is not the central merit of a message, an object or a person. These items were developed based on a set of exploratory questions of a study by Lim and Simon (2011). *Heuristic processing* was measured through the use of a variety of cues in the form of a survey while the participants' read the Wikipedia article. *Peer endorsement* was defined as peers' or friends' acceptance of Wikipedia, which was measured using four items. *Professor endorsement* was defined as professors' acceptance of using Wikipedia. Three items measured this concept. Both concepts were measured based on the measurements of Lim and Simon (2011).

*Use* was defined as the frequency of Wikipedia use during the past 4 months. A 5 point-scale was used for the variables related to the frequency of Wikipedia use. Finally, the degree of Wikipedia use for academic work and whether the participants had ever written or edited a Wikipedia article were measured in an exploratory manner (Table 2).

#### **4. Findings**

The findings were organized into three subsections and by the research questions. The first subsection presents the characteristics of the participants and the descriptive statistics. The second subsection presents the results of the experiment, corresponding to RQ1 through RQ3, and the answer to RQ4. Along the way, the results of the hypothesis testing are reported. Finally, the third subsection reports the other exploratory findings.

##### *4.1. Descriptive statistics*

##### *4.1.1. Participants*

The mean age of the participants was 19.28 (N=123, SD. 2.11). Approximately two-thirds (65.9%, N=81) of the respondents were female, and one-third (34.1%, N=42) was male. A majority of the respondents were Caucasian (87.8%, N=108), followed by Asian (8.9%, N=11), two or more races (1.6%, N=2) and Other (1.6%, N=2). The respondents were distributed across majors. Approximately 39.1% (N=54) were declared natural or applied science majors, followed by the social sciences (27.5%, N=38) and the humanities or arts (13%, N=18). Approximately 21% (N=29) of the respondents had not yet decided on their majors. Finally, the largest group of respondents were first-year students (42.3%, N=52), followed by sophomores (23.6%, N=29), juniors (22.8%, N=28), and seniors (9.8%, N=12). Two respondents fell into the other group (1.6%, N=2).

#### 4.1.2. Frequency of Wikipedia use, academic use of Wikipedia and contribution to Wikipedia

With respect to Wikipedia use in the past 4 months relative to when this study was conducted, among the 123 respondents, 40.2% (N=49) were frequent users, with a frequency of more than 15 times. Approximately 29.5% (N=36) of the respondents used Wikipedia moderately, showing a frequency of between 6 and 15 times. Another 27% (N=33) were occasional users who used it between 1 and 5 times. The rest (3.3%, N=4) did not use Wikipedia during the past four months. In addition, two-thirds of the respondents sometimes (40.7%, N=50) or often (26.1%, N=32) used Wikipedia for academic purposes. Approximately 33.4% (N=41) of students tended not to use Wikipedia for academic purposes. Finally, among the 123 respondents, 11.4% (N=14) reported writing or editing a Wikipedia article (Table 2).

#### 4.2. Results of hypothesis testing

The experiment was intended to answer RQ 1 through RQ3. The research questions from RQ1 through RQ2 were answered by examining two main effects of a peripheral cue (RQ1) and knowledge (RQ2), and an interaction effect between peripheral cue and knowledge (RQ3). A two-way ANOVA was performed to answer RQ1 through RQ3, which corresponded to research hypotheses H1 through H3, respectively (Table 3). A regression analysis was performed for RQ 4, which corresponded to the research hypothesis, H4. A two-tailed test under  $\alpha=0.05$  was performed to test all of the hypotheses.

##### *RQ1. Does a peripheral cue influence the credibility judgments of Wikipedia?*

The index mean of the higher peripheral cue (measured as a higher number of references, 33.39) was higher than that of the lower peripheral cue (measured as a lower number of references, 30.30). This difference was statistically significant under  $\alpha=0.05$ , resulting in the main effect of the peripheral cue. That is, a peripheral cue has an effect on the credibility judgments of Wikipedia, supporting H1. More specifically, the higher peripheral cue, the more credible the respondents judged the article. In this study, the more references, the more credible the respondents judged the article, supporting H1.1 ((F (1, 134) =7.14,  $p<0.008$ , MSE=397.70, partial  $\eta^2=0.051$ ).

##### *RQ2. Does knowledge influence the credibility judgments of Wikipedia?*

The participating students were divided into low and high knowledge groups based on the composite scores of the two survey items for the variable of knowledge. Students whose composite score of knowledge was at or below 6.23 (a mean value) were assigned to the low-knowledge group, and students whose composite score of knowledge was higher than 6.23 were assigned to the high-knowledge group. The index mean of high knowledge on credibility (33.82, N=62) was higher than that of low knowledge (30.55, N=76). This difference was statistically significant under  $\alpha=0.05$ , resulting in the main effect of knowledge. This result indicates that knowledge level has an effect on the credibility judgments of Wikipedia, thus supporting H2. More specifically, the higher the knowledge, the more credible the respondents judged the article ((F (1, 134) =8.103,  $p<0.005$ , MSE=451.32, partial  $\eta^2=0.057$ ).

##### *RQ3. Do the effects of a peripheral cue on credibility judgments differ, according to knowledge?*

There was no significant interaction between peripheral cue and knowledge. The effect of a peripheral cue on credibility judgments was not different between those with high versus low knowledge. Therefore, H3 is not supported. In other words, the difference of credibility

judgments regarding the Wikipedia article with a high peripheral cue (longer reference list) between students of high versus low knowledge was not significantly different from that regarding one with a low peripheral cue (shorter reference list). In this study, the high-knowledge group was affected by a peripheral cue (the length of references) in their credibility judgments as much as the low-knowledge group.

*RQ4. Why do people adopt heuristic processing? More specifically, are perceived credibility, knowledge, cognitive workload, and involvement in a topic related to heuristic processing?*

The results show that among the variables of perceived credibility, knowledge, cognitive workload and involvement, only perceived credibility was positively related to heuristic processing ( $\beta=.283$ ,  $p<0.007$ ). That is, the higher the perceived credibility of Wikipedia, the more the respondents used heuristic processing, thus supporting H4.4. However, the other factors such as cognitive workload or involvement in a topic or knowledge were not related to heuristic processing. As a result, H4.1, H4.2, and H4.3 were not supported. The results indicate that perceived credibility is a predictor of heuristic information processing. Further discussion is given below. Table 4 presents the results.

#### 4.3. *Other findings*

*Professors' endorsement of Wikipedia, peer endorsement of Wikipedia, students' perceived credibility, and students' use of Wikipedia*

Professors' endorsement was positively correlated to students' perceived credibility of Wikipedia ( $r=.358$ ,  $p<.000$ ). In fact, the respondents reported an overall low approval of their professors regarding Wikipedia (a grand mean of 2.79 on a 7-point scale). Interestingly, however, professors' disapproval of Wikipedia was not related to students' general use of Wikipedia. These results are consistent with previous studies (Head & Eisenberg, 2010; Lim & Simon, 2011). On the other hand, students reported observing their friends' or peers' acceptance of Wikipedia (a grand mean of 5.99), despite their professors' discouragement of Wikipedia. Furthermore, students' peer approval was positively related to their perceived credibility of Wikipedia ( $r=.674$ ,  $p<0.000$ ) and their use of Wikipedia ( $r=0.401$ ,  $p<0.000$ ). Finally, students' perceived credibility of Wikipedia was positively correlated with their credibility judgments of a Wikipedia article, for both the high and low experimental conditions ( $r=.497$ ,  $p<.000$  for the high number of references group;  $r=.408$ ,  $p<.003$  for the low number of references group), which appears to support the bias hypothesis of HSM. Table 5 presents the results.

*Optimistic bias toward themselves* The respondents tended to be more confident in their ability to discern the credibility of Wikipedia articles than in others' ability (a mean of 4.70 versus 3.82 respectively). The pair-mean differences were statistically significant ( $t=7.53$ ,  $df=121$ ,  $p<0.000$ ). Further, the respondents believed that others should be more cautious about believing Wikipedia information than they themselves were (a mean of 5.69 versus 5.38;  $t=-1.98$ ,  $df=121$ ,  $p<0.05$ ). These results echo the findings of Flanagin and Metzger (2011), showing that both children and adults perceive themselves more optimistically than others in terms of discerning the credibility of information.

## 5. Discussion

This study provides potential theoretical and practical implications for credibility research and literacy education. First, this study shows that students made credibility judgments using a peripheral cue concerning Wikipedia, an uncertain information environment. This result is consistent with the theory of bounded rationality regarding the use of heuristics in processing information. Further research is needed to examine whether the effect of peripheral cues differs regarding credibility judgments, according to different environments (e.g., uncertain versus certain environments) and how individual variables (cognitive, motivational or emotional factors) play out in various environments. With respect to heuristic processing, none of the variables drawn from HSM such as knowledge, cognitive workload, or involvement in a topic were related to heuristic processing in the context of Wikipedia. Only the perceived credibility of Wikipedia was related to heuristic processing. Despite the need for further investigation, these results may be interpreted to mean that heuristic processing might be independent of cognitive ability or motivation. This result supports the theory of bounded rationality, explaining that humans use heuristics not because they are cognitive misers or their tasks are not important. Rather, this result indicates that the two modes of heuristic and systematic processing may be affected by different factors. For instance, heuristic processing which involves quick judgments may be related to variables other than cognitive or motivational factors (e.g., perceptions, emotions, etc.). Further research is needed to identify such factors. This line of research can improve our understanding of heuristics and their relationship with credibility judgments. In addition, further research is warranted to examine whether this result is replicable to other populations, using different measurements for heuristic processing (e.g., observations rather than self-reports or refined survey items).

Second, this study indicates that students used a heuristic (e.g., “An article with a long list of references is more credible than with of a short one”) in assessing the credibility of Wikipedia. This result suggests that educators and librarians need to accept the reality that heuristic approaches to evaluating information are a common practice among students. In addition, educators and librarians should develop their literacy programs based on such a heuristic and guide students in ways such that they can take full advantage of heuristic approaches. In fact, credibility researchers acknowledge the effectiveness of heuristics in evaluating Web information. For instance, Sundar (2008) contends that a heuristic can be helpful in making a quick judgment about content and can guide systematic information processing. Further, Metzger (2007) remarks that a heuristic approach is more realistic than a traditional checklist method in assessing Web information. At the same time, it is important to note that heuristics do not always generate desirable outcomes. Most notably, Kahneman (2011) provides evidence of systematic errors in heuristics or biased human minds. Similarly, Sundar (2008) points out that a heuristic approach can serve to frame or bias. Indeed, this study indicates that the number of references led students to biased processing, demonstrating that despite the exact text being shown in this experiment to all participants, students judged the version with a higher number of references as being more credible than the one with the lower number. As a result, educators and librarians need to help prevent students from blindly accepting the quantity of references as a signal of credibility by providing some alternative guidelines for evaluating information. Wikipedia contributors also need to better utilize or develop certain peripheral cues that can assist Wikipedia readers to quickly assess the credibility of Wikipedia articles. For instance, the use of certain noticeable symbols regarding references can be helpful in assessing information. Currently Wikipedia offers a few symbols to indicate the quality of Wikipedia

articles assessed. For example, a featured article that is considered as superior has a small bronze star icon on the top right-hand corner of the article's page. It would be helpful for Wikipedia to provide such a symbol in a noticeable way. Educators and librarians need to introduce these symbols explicitly to students. Currently, it is unclear whether students are aware of such symbols. Wikipedia can develop other useful symbols that can serve as cues in assessing the credibility judgments of Wikipedia articles.

Third, subject knowledge influenced the credibility judgments of Wikipedia. The high knowledge group judged the Wikipedia article as more credible than the low knowledge group. This study is consistent with a previous study in which experts found Wikipedia articles to be more credible than non-expert readers (Chesney, 2006). This result can be interpreted to mean that people with low knowledge may be more uneasy with the credibility of Wikipedia than those with high knowledge, thus leading to their underestimation of the Wikipedia article's credibility in the study. It would be interesting to find out whether knowledge has the same effect on credibility judgments concerning information sources by known authors or in a well-defined information environment. This line of research may suggest that the effect of knowledge on credibility judgments may depend on the degree of information uncertainty. In addition, this result suggests that it would be particularly helpful for readers without subject knowledge to access reliable Wikipedia information. Regarding this issue, Wikipedia could team up with professional associations to edit Wikipedia articles in their fields. For instance, the Association of Psychological Science has launched a Wikipedia Initiative to ensure the quality of Wikipedia articles and encourages its members to participate in contributing to Wikipedia (Association for Psychological Science, 2011). Wikipedia could invite other professional associations to expand this kind of effort. The involvement of professional associations in Wikipedia can help Wikipedia readers access reliable information and can help to ensure the quality of articles in their fields. This effort would also help Wikipedia readers without subject knowledge avoid any unnecessary underestimation of or uneasiness with information due to their negative bias against the quality of Wikipedia.

On the other hand, subject knowledge did not interact with the peripheral cue (measured as the length of references) on credibility judgments. That is, the high knowledge group was affected by a peripheral cue (the length of references) in their credibility judgments as much as the low knowledge group. In other words, people's knowledge level (which is important for deliberate information processing) did not decrease the effect of the peripheral cue on their credibility judgments. Despite the needs for further research, this result suggests a couple of possible interpretations. First, this may be an indication that people use heuristics anyways regardless of their knowledge level, which demonstrates the general influence of heuristics in judgments. In addition, within HSM, it is expected that knowledgeable people are likely to employ their knowledge to judge the credibility of information because they are able to evaluate information. It appears that the result of no interaction between knowledge and a peripheral cue is more consistent with the theory of bounded rationality than it is with HSM. Further research is necessary to examine whether multiple measurements of the peripheral cue concept have the same results.

Finally, it is worthwhile to note one of the exploratory findings. That is, peer endorsement of Wikipedia was related to the perception of credibility in Wikipedia. Although the two concepts of perceived credibility and credibility judgments are not the same, this result may imply a role of social endorsement in credibility judgments, given the correlation of the two



concepts in this study. The result may be interpreted as supporting the notion that social endorsement is an important factor affecting the credibility judgments of UGC (Metzger et al., 2010). This result suggests that Wikipedia needs to provide noticeable social cues that can guide Wikipedia readers to quickly evaluate information. Indeed, Wikipedia has started with its Article Feedback Tool since July 2011, which invites users to rate Wikipedia articles at the bottom of the webpage of the respective articles (Wikipedia: Article Feedback Tool, 2011). This tool is similar to the voting or rating system of other social information such as Customer Reviews at Amazon.com. However, unlike the rating system of Amazon.com, Wikipedia readers need to click on “View Page Rating,” which requires one more step to find out that information. The average readers may not be inclined to do so. It would be useful to display ratings without clicking. At the same time, it should be noted that formal authority (e.g., professor endorsement) still plays out in influencing the perception of social information credibility among college students. Further, given the evidence that students hardly used the features of the editing history or discussion of Wikipedia, despite the usefulness of these features in assessing the quality of a Wikipedia article (Lim & Simon, 2011), it would be necessary for Wikipedia to provide easily noticeable cues. In addition, professional associations themselves can provide their own endorsement for the quality of articles in their fields, which would serve as an authoritative cue.

This study has certain limitations and a few suggestions for further research have emerged from the current study. First, both the theory of bounded rationality and the heuristic-systematic serve as the conceptual basis of the study for understanding a heuristic in credibility judgments and understanding why people use heuristics. However, this study did not develop an integrated model that takes into account both theories or test such a model. Instead, this study employed the idea of the influence of peripheral cues on credibility judgments from both theories, leading to one of the key variables of this study. As the theories provide different explanations for heuristics, it would have been useful to develop an integrated model and apply such a model to this study. Indeed, an integrated model that takes into account both environmental and individual factors can improve our understanding of heuristics and their role in credibility judgments. For instance, this study related the notion of Savage’s large world only to Wikipedia, instead of including an environment as a variable in this study. Further research is necessary to determine whether the effect of peripheral cues differs regarding credibility judgments, according to different environments (e.g., uncertain versus certain environments) and how individual variables (cognitive, motivational or emotional factors) play out in different environments. This line of inquiry can be pursued by developing and testing an integrated model, which can help us understand heuristics in relation to credibility judgments in a comprehensive way.

Second, the measurements of certain variables need improvement. This study employed only a peripheral cue. Multiple measures are better than one measure. A test involving a set of knowledge can measure actual knowledge on a topic better than self-reports of knowledge. Further, the variable of knowledge was used as a surrogate variable of cognitive ability, despite their not being the same concepts. The measurements of heuristic processing require improvement, as well. For instance, a survey item describing, “I looked at the headings of the article,” could be better measured as a heuristic with rewording in such a manner as, “The headings of the article deliver the core contents of the article.” In addition, the heuristics could be measured through other methods such as a think-aloud protocol or an experiment. This study indirectly measured peer endorsement using survey items. An experiment examining the role of

social ratings of a Wikipedia article in credibility judgments would be better than self-reports. Wikipedia has started with the Article Feedback Tool. This tool invites Wikipedia readers to rate Wikipedia articles and allows them to view ratings by clicking on the “View Page Rating.” Further investigation is needed to see whether Wikipedia readers indeed click on this option, when they do so and whether this option affects their credibility judgments. In addition, only one article was selected for this experiment. It may be useful to examine several articles with the same quality ratings by Wikipedia. Third, this study employed a convenient sample from nine courses at a university, and the response rate of this study was low. As a result, the findings of this study may not be generalizable to the entire population of university students. Finally, further research is warranted to examine the factors affecting heuristics or heuristic processing, which may be useful in re-conceptualizing the two modes of information processing.

## **6. Conclusion**

The major findings of this study include the following: a peripheral cue and knowledge influenced the credibility judgments of college students concerning Wikipedia. A peripheral cue did not interact with knowledge on credibility judgments. Perceived credibility was related to heuristic processing, but knowledge, cognitive workload or involvement in a topic was not.

This study provides both practical and potential theoretical implications, thereby contributing to literacy education and credibility research. First, this study has potential theoretical implications. This study shows that students made credibility judgments using a peripheral cue concerning Wikipedia, an uncertain information environment, which is consistent with the theory of bounded rationality regarding the use of heuristics in processing information. Further, subject knowledge did not decrease the effect of the peripheral cue on credibility judgments in this study, demonstrating a stronger effect of a peripheral cue (superficial factor) than knowledge (substantial factor) on credibility judgments. These results suggest that credibility researchers need to pay attention when such cues lead to effective credibility judgments and when such cues lead to biased information processing. This kind of research can help educators and librarians develop different strategies regarding heuristics for their information literacy programs. In addition, this study found that there was a relationship between the perceived credibility of Wikipedia and heuristic processing, suggesting further investigation of the role of social information perception in heuristic processing. On the other hand, this study shows that heuristic processing happened, regardless of one’s cognitive ability or motivation. Despite the need for more evidence, it may be possible that the two systematic and heuristic modes of information processing are affected by different factors. Or the two modes of information processing may operate simultaneously due to certain factors or mechanisms that are not explicitly explained in HSM. What factors affect the use of heuristics and whether heuristics are affected by perceptions or other factors (e.g., emotion) need further explanation. These inquiries can be examined by developing and testing an integrated model taking into account the perspectives of both the theory of bounded rationality. This line of research may offer an explanation for why people with high levels of motivation and ability still use heuristics in credibility judgments. Further research should examine whether the results are consistent in other contexts and under other measurements and methods.

Second, this study provides practical implications for educators, librarians and the Wikipedia community. That is, educators and librarians need to integrate heuristic approaches

into teaching Web evaluation and explain to students both the advantages and disadvantages of heuristic approaches. The Wikipedia community also must offer certain cues that can help Wikipedia readers quickly assess the credibility Wikipedia articles. In addition, it may be useful for librarians and educators to provide guidelines for background resources or information on subjects for those who are unfamiliar with those subjects. Finally, Wikipedia can collaborate with experts or professional organizations to ensure the quality of articles, which can help, in particular, readers with low subject knowledge to access reliable information and avoid unnecessary underestimation of UGC.

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Table 1. Variables

Conceptual variables	Survey items	Mean (a 7-point scale)	Standard deviation	Cronbach's $\alpha$ and a grand mean
Credibility	This article is accurate.	4.67	1.298	$\alpha$ =.91 mean: 4.58 (Note: See Table 3 for the means of different levels of peripheral cue)
	The information in this article is verifiable elsewhere.	4.93	1.405	
	This article is reliable.	4.49	1.415	
	This article includes major facts of the topic.	5.22	1.277	
	This article presents views fairly and without bias.	3.64	1.579	
	This article is trustworthy.	4.06	1.392	
	This article is believable.	5.01	1.312	
Perceived credibility of Wikipedia	Overall Wikipedia articles are reasonably accurate.	5.14	1.140	$\alpha$ =.88 mean: 5.06



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	Overall information in Wikipedia is verifiable elsewhere.	5.32	1.100	
	Overall information in Wikipedia is reliable.	4.85	1.281	
	Overall Wikipedia articles include major facts about the topic.	5.73	.952	
	Overall Wikipedia articles present views fairly and without bias.	4.32	1.270	
	Overall Wikipedia articles are trustworthy.	4.66	1.206	
	Overall Wikipedia articles are believable.	5.38	.945	
Knowledge	I have some knowledge about the environmental issues of meat production.	3.72	1.823	$\alpha=.85$ mean: 3.12
	I have a considerable amount of knowledge about the environmental issues of meat production.	2.51	1.609	
Cognitive workload	This article was difficult to follow.	3.19	1.503	$\alpha=.87$ mean: 3.56
	I felt stressed while I was reading this article.	2.86	1.339	
	I felt distracted while I was reading this article.	3.96	1.676	
	My mind wandered while I was reading this article.	4.30	1.699	
	I paid attention to this article.*	3.48	1.296	
Involvement	This topic is relevant to me.	4.06	1.641	$\alpha=.78$ mean: 3.67
	This topic has been on my mind lately.	2.28	1.529	
	This article made me think about this issue.	4.84	1.450	
	I am motivated to learn more about the environmental issues of meat production.	3.50	1.475	

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Heuristic processing	I looked at the headings of the article.	5.55	1.371	$\alpha=.76$ mean: 4.51
	I scanned the length of the article.	5.52	1.490	
	I scanned the references of the article.	4.37	1.974	
	I scanned the quantity of citations of the article.	4.09	1.947	
	I scanned whether notable sources were cited.	3.85	1.934	
	I looked at the list of contents of the article.	4.76	1.755	
	I checked if there was a warning message.	2.94	1.766	
	I checked if there were any external links.	4.01	2.002	
	I looked at the table in the article.	4.91	1.850	
	I scanned the content of the article.	5.06	1.513	
Peer endorsement	My friends or peers use Wikipedia.	6.40	.801	$\alpha=.88$ mean: 5.99
	My friends or peers have said that they find useful information from Wikipedia.	6.07	.959	
	My friends or peers have said that Wikipedia is reasonably accurate.	5.47	1.170	
	My friends or peers like Wikipedia.	6.01	.953	
Professor endorsement	Most of my professors allow me to use Wikipedia.	3.06	1.714	$\alpha=.90$ mean: 2.79
	Most of my professors think that Wikipedia is a good information source.	2.72	1.456	
	Most of my professors allow me to use Wikipedia for my academic work.	2.59	1.520	

Item\*-Reversed scores were used to obtain a grand mean and a reliability coefficient. All variables were rated on a 7-point scale with the anchors “strongly disagree” and “strongly agree.”

Table 2. Use

Wrote or edited a Wikipedia article	Yes	N=14	11.4%
	No	N=109	88.6%
Wikipedia use in the past 4 months	0	N=4	3.3%
	1-5	N=33	27.0%
	6-10	N=22	18.0%
	11-15	N=14	11.5%
	More than 15	N=49	40.2%
Wikipedia use for academic work	Never	N=6	4.9%
		N=35	28.5%
		N=50	40.7%
		N=20	16.3%
	Very often	N=12	9.8%

Table 3. Credibility across a peripheral cue and knowledge

	Low knowledge			High knowledge			Total
	M	SD	N	M	SD	N	
Low cue	28.23 (4.03)	8.19	30	32.29 (4.61)	8.23	31	30.30 (4.33)
High cue	32.07 (4.58)	6.86	46	35.35 (5.05)	6.75	31	33.38 (4.77)
Total	30.55 (4.36)	7.60	76	33.82 (4.83)	7.63	62	138

Notes: Mean is an index mean. A grand mean on a 7 point scale per each category is presented in a parenthesis.

Table 4. Regression analysis on heuristic processing

Variable	$\beta$	t	p-value	Zero-order correlation	Part correlation
Perceived credibility	.283	2.758	.007*	.239	.248
Knowledge	.115	1.207	.230	.157	.109
Cognitive workload	-.099	-1.001	.319	-.156	-.090
Involvement	-.157	-1.508	.134	.007	-.136
N	115				
R <sup>2</sup>	.100				
Dependent variable	Heuristic processing			p* < .05	

Table 5. Correlations

	Peer endorsement	Professor endorsement	Perceived credibility	Use
Peer endorsement	1	.136 (.137)	.674* (.000)	.401* (.000)
Professor endorsement		1	.358* (.000)	-.017 (.849)
Perceived credibility			1	.431* (.000)
Use				1

Pearson correlation (p-value), p\* < .05