Perceiving online public opinion : a study of the effects of Facebook opinion cues, opinion climate congruency, & source credibility on willingness to speak out

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2019

Leong, A. D. X. L. (2019). Perceiving online public opinion : a study of the effects of Facebook opinion cues, opinion climate congruency, & source credibility on willingness to speak out. Master's thesis, Nanyang Technological University, Singapore.

<https://hdl.handle.net/10356/87639>

<https://doi.org/10.32657/10220/48328>

**NANYANG
TECHNOLOGICAL
UNIVERSITY**

SINGAPORE

**PERCEIVING ONLINE PUBLIC OPINION: A STUDY OF THE EFFECTS OF
FACEBOOK OPINION CUES, OPINION CLIMATE CONGRUENCY, &
SOURCE CREDIBILITY ON WILLINGNESS TO SPEAK OUT**

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WEE KIM WEE SCHOOL OF COMMUNICATION AND INFORMATION

2019

**Perceiving Online Public Opinion: A Study of the Effects of Facebook Opinion
Cues, Opinion Climate Congruency, & Source Credibility on Willingness to
Speak Out**

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A thesis submitted to Nanyang Technological University in partial fulfillment of the
requirements for the Master of Communication Studies

2019

Wee Kim Wee School of Communication and Information

Supervisor: Assoc. Prof Shirley Ho Soo Yee

Statement of Originality

I certify that all work submitted for this thesis is my original work. I declare that no other person's work has been used without due acknowledgement. Except where it is clearly stated that I have used some of this material elsewhere, this work has not been presented by me for assessment in any other institution or University. I certify that the data collected for this project are authentic and the investigations were conducted in accordance with the ethics policies and integrity standards of Nanyang Technological University and that the research data are presented honestly and without prejudice.

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This thesis contains material from 0 paper(s) published in the following peer-reviewed journal(s) where I was the first and/or corresponding author.

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Leong Xue Li Alisius Deon

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my supervisor, Dr. Shirley Ho for her guidance and support. She has played a huge role in my academic journey and my development as a budding scholar. I am grateful for her patience and dedication in teaching me, and pushing me out of my comfort zone to achieve my maximum potential.

I would also like to extend my gratitude to Dr. Benjamin Detenber for his insightful advice and suggestions that were immensely helpful for the formulation of my research ideas and played a crucial role in improving my writing.

This journey would not be possible without the support and encouragement of my family. I am also thankful for my friends who have made these two years so much more enjoyable. Specifically, I would like to thank my officemates and Agnes for their friendship, support, and help, both academically and personally.

I would also like to acknowledge the Wee Kim Wee School of Communication and Information for their administrative and financial support that has helped me to successfully complete this thesis.

ABSTRACT

Facebook's novel affordances and unique features have transformed the way people assess public opinion. Opinion cues such as user-generated comments (UGCs) and aggregated user representations (AURs) offer users original ways to infer public opinion. Drawing on the spiral of silence theory, a nascent body of literature has investigated the roles of UGCs and AURs on perceptions of the opinion climate. However, the inconclusive findings and the recent launch of reaction emojis highlight a need to re-examine the role of AURs, and the relative influence of UGCs and AURs on perceptions of the opinion climate. Innovative features on Facebook have also triggered new research trajectories to understand how heuristic cues such as source credibility might influence the public's willingness to speak out. This experimental study (embedded in the form of an online survey) adopted a 3 x 2 x 2 between-subjects factorial design. This study provided 360 Facebook users aged 21 and above with a mock-up Facebook page, manipulated in terms of opinion cues (UGCs-only vs. AURs-only vs. UGCs-and-AURs), opinion climate congruency (congruent opinion climate vs. incongruent opinion climate), and source credibility (high source credibility vs. low source credibility). Theoretically, this study contributes to the spiral of silence literature as it is the pioneering piece to elucidate how AURs represented by reaction emojis influence perceptions of the opinion climate. It is also the first study to investigate how source credibility may influence silencing effects. Practically, the findings can inform relevant stakeholders about the dynamics of online public opinion formation to help them identify and inhibit subversive online behavior. It also illuminates the role of source credibility that can inform the engenderment of effective communication and outreach efforts.

Keywords: spiral of silence theory, user-generated comments, aggregated user representations, opinion climate congruency, source credibility, willingness to speak out

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CHAPTER ONE INTRODUCTION

The dominant role that the mass media play in shaping perceptions of public opinion has been widely acknowledged in media research. Audiences are constantly bombarded with consonant messages from the ubiquitous mass media in the traditional media environment, which creates the perception that media messages are reflective of the broader opinion landscape (Gunther, 1998). Such perceptions of public opinion are crucial as they have been found to influence opinions (Tsfati, Stroud, & Chotiner, 2014), opinion expression (Glynn & Huge, 2014), and subsequent behavior (Dvir-Gvirsman, Garrett, & Tsfati, 2015). Recognized as one of the most prominent theories of public opinion, the spiral of silence theory states that individuals' perceived congruence with the opinion climate presented through the mass media plays a crucial role in influencing willingness to speak out, and the eventual establishment of the dominant position (Noelle-Neumann, 1974). Thus, the mass media undeniably play a vital role in the public opinion formation process.

With the advent and proliferation of online and social media sites, there is a renewed interest to examine how public opinion manifests in the online realm. The shift in focus from traditional media channels to new media channels can be attributed to the prominent role that the latter plays in presenting the opinion climate in the contemporary media environment. Particularly, Facebook is noteworthy of examination given its extensive reach and widespread influence. The rise in Facebook use has been evident since 2009, which marked a turning point in the way people utilize online and social media sites (Hennig-Thurau et al., 2010). Over the years, Facebook has been increasingly adopted as a platform to monitor public opinion (Pew Research Center, 2017a). As of 2017, Facebook has solidified its status as the leading and most influential online and social media site, with a reported 2 billion active users

monthly (Fiegerman, 2017). Over three-quarters of Facebook users were reported to log onto the platform daily (Pew Research Center, 2017b). These figures are particularly relevant in the Singaporean context given the Republic's high Facebook penetration rate (Statistica, 2018a). The number of current active Facebook users in Singapore has exceeded 3 million, and this figure is projected to be on an upward trend in the coming years (Statistica, 2018b). Given Facebook's extensive reach and pervasive influence, it is vital to examine how public opinion manifests on the platform.

Novel affordances and unique features available on Facebook have altered the way people engage in, and monitor public opinion. Opinion cues such as user-generated comments (UGCs) and aggregated user representations (AURs; Walther & Jang, 2012) may be perceived as indicators of public opinion. UGCs left in comment boxes following a Facebook post reflect public sentiments toward the post or issue. Similarly, AURs that manifest in the form of a cumulative number of "likes" following a Facebook post provide a summary statistic of users' attitudes toward the post or issue. In addition, unique Facebook features such as Facebook group pages that allow for the restriction and involvement of specific segment(s) of users may influence Facebook users' perceptions and evaluations of the opinion climate.

Perceptions of the Opinion Climate

Given the development of and variety of opinion cues available to gauge the opinion climate, it is important to illuminate the social-psychological mechanism underlying perceptions of online public opinion. A nascent body of research exploring the effects of UGCs and AURs on perceptions of the opinion climate found that UGCs serve as a stronger indicator of the opinion climate than AURs (Lee & Jang, 2010; Neubaum & Krämer, 2017). However, these findings could be ascribed to the

inequivalent manipulation of UGCs and AURs, in part, due to the limitations of the platform's features. In earlier studies, UGCs were manipulated in terms of positive comments and negative comments, while AURs were manipulated in terms of a high number of "likes" and a low number of "likes." Arguably, the low number of "likes" fall short of portraying the unfavorable opinion climate depicted by the negative comments. However, Facebook's introduction of reaction emojis (i.e., "Love," "Haha," "Wow," "Sad," and "Angry"), which are graphic symbols that emulate facial expressions, allow users to more accurately express both positive and negative emotions through AURs. Thus, this study seeks to fill an existing research gap by examining the effect of AURs with the inclusion of reaction emojis to allow for a more precise determination of AURs' influence on perceptions of the opinion climate, as well as to provide a more equivalent comparison of the effect of UGCs and AURs on perceptions of the opinion climate.

Evaluations of the Opinion Climate

Aside from its novel affordances, Facebook also possesses unique platform features that could influence audiences' assessment of the opinion climate. As with most online and social media platforms, Facebook encourages content contribution and user interaction. However, unlike traditional media platforms that are strictly monitored by gatekeepers, Facebook allows anyone to post content. The openness of the platform has resulted in an abundance of information from a multitude of information sources. Due to their limited cognitive capacity, users may rely on features such as Facebook groups that enable the specification and restriction of group membership (e.g., experts, laypeople) as a heuristic cue to evaluate the content posted. Past research has found that people tend to rely on source credibility as a heuristic cue in the face of uncertainty and information overload to evaluate the reliability of

information provided (Sundar, 2008; Wirth, Böcking, Karnowski, & von Pape, 2007). This perceived source credibility in turn influences people's acceptance or rejection of the information provided (Hennig-Thurau, Gwinner, Walsh, & Gremler, 2004). Little is known about the effect of source credibility on people's evaluations of the opinion climate and their willingness to speak out. Thus, this study seeks to build on extant spiral of silence and source credibility research by assessing the effect of source credibility on willingness to speak out. It will also examine how source credibility moderates opinion climate congruency to affect willingness to speak out.

Objectives and Implications of Study

This study consists of three key objectives. First, it seeks to elucidate how opinion cues represented by UGCs and AURs with the inclusion of reaction emojis influence people's perceptions of the opinion climate. Second, it seeks to examine how source credibility influences people's willingness to speak out. Third, it seeks to explore the moderating effect of source credibility and opinion climate congruency on willingness to speak out.

This study contributes to the spiral of silence literature by illuminating the social-psychological mechanisms influencing perceptions of the opinion climate and willingness to speak out in the contemporary media environment that contains novel opinion cues and unique features. Specifically, it serves as the pioneering study to elucidate the effect of AURs represented by reaction emojis on perceptions of the opinion climate. It is also the first study to examine the spiral of silence and source credibility in conjunction with one another. By investigating the role of source credibility on willingness to speak out, this study will illuminate how source credibility influences perceptions and evaluations of the opinion climate. It will also contribute to both the spiral of silence and source credibility literature by examining

the moderation effect of source credibility and opinion climate congruency on willingness to speak out. Practically, insights from this study can inform policymakers and communicators about public opinion formation in the online and social media environment to aid them in identifying and inhibiting subversive online behaviors that seek to influence public opinion regarding issues of national significance. It will also elucidate the importance of source credibility in the transmission of information that can be utilized to engender more effective communication and outreach efforts regarding novel and controversial science and technologies.

Organization of Chapters

This thesis consists of five chapters. Chapter two elaborates on and explains about public opinion, the SOS theory, and the source credibility framework. It seeks to elucidate the spiral of silence theory by providing a broad understanding of the social-psychological perspective of public opinion adopted in the context of the spiral of silence, and introduce the key assumptions of the spiral of silence theory that are central to this study. In this chapter, I will justify the need to examine novel affordances such as reaction emojis on Facebook to explain how they influence public opinion dynamics. I will also juxtapose the source credibility framework with the spiral of silence theory to understand how new media features influence public perceptions and evaluations of the opinion climate to impact willingness to speak out. This chapter primarily serves to lay the theoretical foundation, rationale, and arguments leading up to the hypotheses and research question. Chapter three describes the research methodology used for data collection. In this chapter, I will elaborate on the study design, sampling procedures, experimental stimulus, and measures used. Chapter four reports the findings from the hypotheses and research question posited. Chapter five discusses and interprets the findings of this study by referencing existing

literature, and lists the potential theoretical and practical implications of this study. In this chapter, I will also outline the limitations of this study, and provide recommendations and directions for future research. Last but not least, I will provide closure to this thesis by reviewing, summarizing, and synthesizing the key findings from this study to reiterate its key contributions to theory and practice.

CHAPTER TWO LITERATURE REVIEW

Public Opinion

Two perspectives of public opinion provide vastly diverging frameworks to understand how consensus is formed in the society. The rational perspective of public opinion views social consensus as the result of reasonable debate among a knowledgeable and concerned public striving towards a common good (Habermas, 1962). In contrast, the social control perspective of public opinion views social consensus as the result of conformity induced by the fear of isolation (Noelle-Neumann, 1974). A larger proportion of public opinion scholars today adopt the social control perspective of public opinion over the rational perspective of public opinion, citing several weaknesses of the latter. First, the rational perspective hinges on the idealistic presumption that people are altruistic and seek to advance the interests of society rather than their personal agendas. However, people are inherently selfish and behave primarily to maximize their own interests (Slote, 1964). Second, the rational perspective fallaciously assumes that every citizen is competent to form opinions on important issues. Yet, it has been argued that people are generally inattentive, unconcerned, or lacking access to information to formulate opinions about issues (Lippmann, 1922). Third, the rational perspective assumes that people think in a logical and rational manner. This overlooks the role that affective and non-rational considerations play in the public opinion formation process. As such, the influence of emotional appeals and emotion contagion frequently observed in the study of public opinion has been largely left unaccounted for (Edelman, 1964). By taking into account social-psychological motivations, the social control perspective of public opinion provides a more plausible explanation to understand how consensus is achieved

among individuals with limited knowledge, as well as disparate and competing interests in comparison with the rational perspective of public opinion.

Solomon Asch is among the earliest scholars to establish support for the social control perspective of public opinion through empirical research. The Asch experiments have been widely referenced in social influence literature to illustrate the effect of group pressure on individuals' behavior. Asch evoked such effects by asking participants to match the length of lines on two sets of cards in a group setting, which consisted of 7 to 9 confederates alongside the participant (Asch, 1955). Participants were required to voice their answers after making a judgment and hearing all the confederates' responses. Although the correct answer was apparent, the findings revealed that people chose to conform to the majority that provided the wrong answer (Asch, 1955). This pattern of compliance with the majority has been replicated and corroborated across multiple studies (Deutsch & Gerard, 1955; Larsen, 1974; Mori & Arai, 2010). The consistent findings from subsequent studies attest to the veracity and pervasiveness of the social control perspective of public opinion among sensible and well-reasoned members of society.

Spiral of Silence Theory

The spiral of silence theory adopts the social control perspective of public opinion. Noelle-Neumann (1974) drew on the Asch conformity research to serve as the buttress of the spiral of silence theory. She hypothesized that public opinion emerges from the interaction between people and their social environment. Particularly, it refers to the way that people express their sentiments publicly to achieve sufficient levels of integration with the larger society. The spiral of silence theory rests on the key assumption that individuals possess an inherent fear of isolation, which motivates them to scrutinize their environment via their quasi-

statistical sense to assess the opinion climate (Noelle-Neumann, 1974). Based on this assessment, one's perceived congruency with the popular position influences his or her willingness to speak out. To elaborate, those who perceive their position to be aligned with the majority would be more likely to speak out, while those who perceive their position to contradict the majority would be less likely to speak out. Over time, this creates a spiraling process where the majority position is solidified, while the minority position fades into obscurity (Noelle-Neumann, 1974). In summary, through the perspective of the spiral of silence theory, public opinion formation is governed by people's perceptions of opinion climate congruency and their fear of isolation.

Nature of issue. One key prerequisite for the silencing effect to take place is that the issue of interest needs to be controversial and/or morally loaded (Noelle-Neumann, 1974). This is because the contentious or ethical aspect of public opinion has the greatest potential to assert the threat of isolation. Generally, such issues are difficult to evaluate objectively, in terms of what constitutes right or wrong. In many instances, people rely on their pre-existing values and beliefs to make subjective judgments. As there is no standard to ascertain the significance and veracity of one point of view over another, people can be pressured to conform in any direction based on the majority position. An examination of the spiral of silence literature reveals a variety of topics, ranging from issues such as the death penalty (Hayes, Glynn, & Shanahan, 2005) to abortion (Salmon & Neuwirth, 1990). Notably, all the topics examined share the common element of being controversial and/or morally loaded.

For the present study, I will test the spiraling effect in the context of nuclear energy. This is because nuclear energy is a sufficiently controversial topic that can elicit spiral of silence effects (Miyata, Yamamoto, & Ogawa, 2015). For decades, the adoption of nuclear energy into a country's energy mix has attracted much public

discourse and has been subjected to considerable contention globally (World Nuclear Association, 2015). Advocates of nuclear energy adoption laud it as a secure, stable, and sustainable source of electricity (e.g., Ho, 2016). Conversely, detractors of nuclear energy adoption raise opposition, citing the environmental and security risks that nuclear technology entail (International Atomic Energy Agency, 2014). Multiple studies have been conducted to understand public opinion towards nuclear energy (e.g., Ho et al., 2018; Ho, Leong, Looi, & Chuah, 2019; Ho, Looi, Chuah, Leong, Pang, 2018). Despite the multiplicity of debates and studies arguing about the benefits and costs of nuclear energy, the public remains divided in their opinions about it.

The issue of nuclear energy is worthwhile to examine in the Singapore context due to its burgeoning prominence and the increased media spotlight placed on it. Such attention can be attributed to plans in the Southeast Asian region to adopt nuclear energy as an alternative source of energy to cope with rising energy demands (Kotwani, 2015). While plans for nuclear energy adoption in Singapore remain ambiguous, strategies to enhance nuclear-related expertise and capabilities are currently underway (Leong, 2016). Moreover, considerations of a nuclear-powered future are ongoing primarily due to the desire to achieve energy security. Currently, Singapore is reliant on neighboring countries such as Malaysia and Indonesia for 95% of its energy supply (National Climate Change Secretariat, 2016). This makes the energy supply and the economy vulnerable to threats in the case of political disputes (Pennington, 2017). Nuclear energy mitigates this reliance by offering Singapore the ability to achieve energy security and independence, on top of providing affordable electricity and diminishing carbon footprint (Pennington, 2017). Given the potential of nuclear energy adoption in Singapore in the future, it is necessary to gain a better understanding of public perceptions toward nuclear energy in the Republic.

Public opinion is among the foremost considerations for policymakers when formulating new policies and developing expertise and capabilities related to controversial science and technology such as nuclear energy. Past experiences have emphasized the role of public acceptance and support for the adoption and implementation of controversial science and technology, as the failure to do so had resulted in public opposition and stalled plans (Rankin, 2015). Due to the salience and personal relevance of this issue, many Singaporeans have taken to online platforms (Lim, 2017) to express their opinions (Lim, 2016; Soezean, 2017). As such, online and social media platforms could potentially shape public attitudes toward nuclear energy in the long run. Thus, it is imperative to understand how novel opinion cues influence people's perceptions of the online opinion climate, and how unique features of the platform affect people's evaluations of the source credibility of online information. It is also important to illuminate how these factors affect willingness to speak out on controversial and/or morally laden issues. Knowledge of such factors is crucial to determine the feasibility of developing controversial science and technology (e.g., nuclear energy) in Singapore.

Opinion climate congruency. Opinion climate congruency is a key factor that influences the spiraling effect, and it has been examined across various empirical spiral of silence studies. The significance of having a supportive environment that corroborates one's position on a contentious and/or ethical issue is compelled by people's inherent fear of isolation. Society threatens deviants with social sanctions or punishments to achieve order and harmony among a vastly differentiated public. Extant research has provided empirical support for this phenomenon, demonstrating that groups ostracize deviants on the basis of threat to group identity, cohesion, or idiosyncrasies (Jetten & Hornsey, 2014; Pinto, Marques, Levine, & Abrams, 2010).

Conformity behavior can be explained in terms of people's need for inclusion (Baumeister & Leary, 1995), relate to others (Ryan & Deci, 2000), or avoid ostracism (Sommer, Williams, Ciarocco, & Baumeister, 2001). The negative effects of ostracism have been shown to result in psychological, emotional, and physical ramifications (Wesselmann, Hales, Ren, & Williams, 2015), which produce such aversive effects that people would rather conform than challenge the majority. As such, the fear of isolation can be understood to motivate conformity based on a fundamental drive to be accepted by the larger group. Thus, people's speaking out behavior is dependent on whether their sentiments are consistent with the majority position.

The role that opinion climate congruency plays in eliciting spiral of silence effects have been demonstrated in extant research. Empirical studies have provided evidence that perceptions of opinion climate congruency influenced people's willingness to speak out (Moy, Domke, & Stamm, 2001; Scheufele, Shanahan, & Lee, 2001). Specifically, people were found to be more willing to speak out when faced with a congruent opinion climate, and less so when faced with an incongruent opinion climate. In prior studies, opinion climate congruency is often conceptualized as the degree of agreement between an individual's opinion and his or her perceptions of the opinion climate (Noelle-Neumann, 1974). Opinion climate congruency is typically operationalized in terms of respondents' self-report of their perceived degree of agreement with their immediate environment (Nekmat & Gonzenbach, 2013), their reference groups (e.g., friends and family; Moy et al., 2001), or the population at the national level (Salmon & Neuwirth, 1990). Based on this self-report, participants will fall into either a congruent or incongruent opinion climate for analysis. For the purpose of this study, opinion climate congruency will be operationalized in terms of

the degree of agreement between one's initial self-reported attitude towards nuclear energy and the valence of the opinion climate they are subsequently exposed to.

Perceiving the Mediated Opinion Climate

Online and social media sites have transformed the way people perceive the opinion climate. Instead of relying on top-down information dissemination from the mass media, people are adopting a bottom-up approach of seeking online user feedback to assess the distribution of opinions. This shift in information acquisition patterns can be attributed to the popularity of online platforms, and the ease of monitoring and contributing feedback online. On online and social media sites such as Facebook, online user feedback typically refers to online users' opinion expression directed towards a post (e.g., news, clips, or images). Past studies have found that audiences tend to interpret online user feedback as reflecting public opinion despite their limited representativeness (Lee, 2012; Lee & Jang, 2010). These findings suggest that online user feedback has the ability to influence perceptions of opinion climate congruency, through the comparison of one's opinion with the perceived majority opinion reflected through online user feedback. Online user feedback is usually embodied in two forms: user-generated comments (UGCs) and/or aggregated user representations (AURs).

User-generated comments. UGCs function as a form of online user feedback that allow people to infer the opinion climate. They frequently manifest in the form of comments that are left by non-proprietary users, that is, visitors of a webpage. UGCs are typically juxtaposed alongside proprietary content, which refer to content created by the author of the webpage (Walther & Jang, 2012). On Facebook, UGCs refer to the comments left in the comment boxes below a post. Fueled by the interactive and collaborative culture of online and social media, UGCs have gained traction as a

popular means for netizens to publicly express their viewpoints (Weber, 2014).

Notably, users were observed to leave subjective comments that were biased in favor of one side of an argument when commenting about controversial issues (Toepfl & Piwoni, 2015). Thus, UGCs can be considered as a form of opinion cue that allow others to infer the opinion climate regarding an issue or content.

The exemplification theory can help to elucidate the role of UGCs on audience perceptions of the opinion climate. According to the exemplification theory, UGCs serve as *exemplars*, which frequently manifest in the form of testimonials, examples, or stories, and serve to offer vivid and concrete illustrations for otherwise abstract and complex issues (Zillmann & Brosius, 2000). Exemplars primarily function based on the representativeness heuristic. According to the representativeness heuristic, people often rely on heuristics to form opinions in the face of uncertainty and insufficient knowledge due to their limited motivation and ability for cognitive processing of complex topics (e.g., nuclear energy; Tversky & Kahneman, 1973). The representative heuristic stipulates that people generalize singular information in earlier encounters as representing a wider phenomenon, and use them to form judgments (Zillmann, 2002). Following this line of argument, people who encounter exemplars about nuclear energy would generalize them as being reflective of public opinion about it, and use them to form opinions and make decisions (Brosius, 1999; Brosius & Bathelt, 1994). This argument has been supported by findings that demonstrated how exposure to the opinion climate distribution represented by exemplars influenced people's perceptions of the future opinion distribution (Perry & Gozenbach, 1997). As such, it can be reasonably inferred that UGCs function as exemplars that are perceived to reflect the opinion climate. Thus, I posit:

H1(a): People who are presented with congruent UGCs-only will perceive the opinion climate to be more supportive of their view on nuclear energy than people who are presented with incongruent UGCs-only.

Aggregated user representations. AURs serve as another form of online user feedback that allow people to infer the opinion climate. AURs refer to descriptive statistics of user ratings represented in terms of the collective number of “likes,” or “+1” ratings (Walther & Jang, 2012). On Facebook, AURs are represented by an aggregated number of “likes” below each post that indicates the general sentiment towards a post (Stinson, 2016). Through such numerical representations, users are made cognizant of other’s attitudes (e.g., supportive or unsupportive) toward an issue or topic (Lünich, Rössler, & Hautzer, 2012). The quantity of online user feedback was found to be associated with audiences’ subsequent attitudes and behaviors (Duan, Gu, & Whinston, 2008; Ellison & Fudenberg, 1995). Specifically, research has provided evidence that audiences generalize numeric aggregations as being representative of public opinion (Daschmann, 2000; Sonck & Loosveldt, 2010; Zerback, Koch, & Krämer, 2015). In such instances, people rely on AURs as representations of the opinion climate to assess the acceptability or appropriateness of a point of view amid the abundance of information availability and attitude uncertainty regarding an obscure topic (e.g., nuclear energy; Flanagin & Metzger, 2008). As such, it can be reasonably assumed that AURs function as numeric cues that shape audiences’ perceptions of the opinion climate regarding nuclear energy. Thus, I posit:

H1(b): People who are presented with congruent AURs-only will perceive the opinion climate to be more supportive of their view on nuclear energy than people who are presented with incongruent AURs-only.

Collective influence of UGCs and AURs. As abovementioned, UGCs and AURs function as opinion cues that influence people's perceptions of the opinion climate about nuclear energy. Thus, people's perceived congruency with the opinion climate reflected through either UGCs-only or AURs-only could potentially impact their perceptions of how supportive the opinion climate is of their position regarding nuclear energy. It is highly probable that the cumulative power of UGCs and AURs would have an amplified effect on perceptions of the opinion climate in comparison to only one opinion cue or the other. In online word-of-mouth research, scholars have acknowledged the independent roles that UGCs and AURs play in influencing people's attitudes and behavior. However, scholars have also pointed out that AURs may be limited in their ability to express the polarity of information (Chevalier & Mayzlin, 2006; Ghose & Ipeirotis, 2011). For instance, on Facebook, users can express positive sentiments through "likes," but are not able to express negative sentiments (i.e., the lack of a "dislike" button). UGCs can supplement the effects of AURs to more strongly influence people's perceptions of the opinion climate. For instance, Facebook users can leave a positive comment aside from clicking "like" to express their support for the post or issue.

Moreover, scholars have suggested that when people are sufficiently motivated, there is an additive effect of both heuristic and systematic information processing on attitudes and behavior (Bohner, Chaiken, & Hunyadi, 1994; Chaiken & Maheswaran, 1994; Zhang, Zhao, Cheung, & Lee, 2014). To elaborate, when individuals intend to use reviews for information search and for information evaluation, both types of opinion cues jointly influence attitudes (Hu, Koh, & Reddy, 2014). Notably, when the UGCs and AURs are consistent with each other, the combined impact of the cues on attitudes and behavior will be amplified (Baek, Ahn,

& Choi, 2012). As such, it is reasonable to infer that the collective influence of UGCs and AURs will influence people's perceptions of the opinion climate. Thus, I posit:

H1(c): People who are presented with congruent UGCs-and-AURs will perceive the opinion climate to be more supportive of their view on nuclear energy than people who are presented with incongruent UGCs-and-AURs.

Relative influence of UGCs and AURs. The two kinds of cues often appear on online and social media sites in conjunction with one another. Therefore, the degree to which they complement or compete with one another can be assessed. Extant literature provides mixed arguments about the role of UGCs and AURs on perceptions of the opinion climate. On one hand, AURs were argued to provide a more representative and precise reflection of the opinion distribution since a wider fraction of the audience participate in opinion expression through AURs than UGCs (Brosius & Bathelt, 1994). Social media posts often garner a larger number of "likes" than comments. This is primarily due to the ease of participation, as commenting would require significantly more effort than a simple click of a button (Pang et al., 2016). On the other hand, UGCs were argued as being more reflective of public opinion due to their vividness. Users tend to include personal anecdotes in UGCs, which make them more memorable than the dull numbers reflected through AURs. According to the availability heuristic, people are more inclined to make judgments based on concrete examples that are salient in their minds (Tversky & Kahneman, 1973). Indeed, past studies have shown that people were more likely to base their perceptions of the opinion distribution on exemplars than statistical information (Brosius, 1999; Brosius & Bathelt, 1994).

Despite this, empirical studies that simultaneously evaluated both types of opinion cues found the effect of UGCs to supersede that of AURs in affecting people's

perceptions of the opinion climate (Lee & Jang, 2010; Neubaum & Krämer, 2017). These findings could be attributed to the inequivalent manipulation of UGCs and AURs in earlier studies. While UGCs were manipulated in terms of positive-valence comments and negative-valence comments, AURs were manipulated in terms of a high number of “likes” and a low number of “likes” (Lee & Jang, 2010; Neubaum & Krämer, 2017). Arguably, a low number of “likes” is unable to accurately portray the unfavorable sentiments of negative comments. Such manipulation could have been due to technological constraints of Facebook in the past. The operational problems in earlier studies may be mitigated by Facebook’s recent addition of reaction emojis – “Love,” “Haha,” “Wow,” “Sad,” and “Angry” – that allow for a wider range of expression from which people can infer the opinion climate.

Classifying emotionality of reaction emojis. To illuminate the significance of the role of reaction emojis as AURs, it is necessary to understand what emotion audiences perceive each reaction emoji to symbolize. Emotions is a multi-faceted concept that is characterized as being discrete and transitory in nature, occurring under provocation in specific circumstances in response to personally significant events (Tracy & Randles, 2011). Emotions are broadly distinguished into positive and negative emotions (Berkowitz, 1999; Watson & Clark, 1992), and can be expressed verbally through words or non-verbally through facial expressions and body language. As communication diffuses to mediated platforms, new modes of expressions such as emojis were introduced to allow people to better express themselves in a cues filtered-out environment. Emojis are graphical symbols that depict facial expressions (e.g., laughing), actions (e.g., running), or gestures (e.g., thumbs up) that serve the dual function of allowing their author to express emotions (Derks, Bos, & Von Grumbkow, 2008; Rezabek & Cochenour, 1998), and enhance audiences’ understanding of the

message (Dresner & Herring, 2010). The prevalence of emojis as a mode of opinion expression can be observed through its popularity on Instagram, where it was reported to be present in roughly half of the messages posted by users (Issac, 2015). This demonstrates that the utility value of emojis in message construction on online and social media has been acknowledged, and widely adopted as a feature of everyday mediated communication.

The prevalence of emojis has also spurred research interest in sentiment analysis. In sentiment analysis research, these non-verbal cues were analyzed to estimate public attitudes toward various issues (Hogenboom, Bal, Frasincar, Bal, de Jong, & Kaymak, 2013; Novak, Smailović, Sluban, & Mozetič, 2015; Thelwall, Buckley, Paltoglou, Cai, & Kappas, 2010). Using sentiment analysis, Novak et al. (2015) constructed an emoji sentiment lexicon, the Emoji Sentiment Ranking, which analyzed emojis in terms of their valence and the intensity of their valence. Juxtaposing the Facebook reaction emojis against the Emoji Sentiment Ranking, “Love,” “Like,” “Haha,” and “Wow” were categorized as positive-valence emotions in descending intensity. That is, “Love” is perceived to depict the most positive emotions, followed by “Like,” “Haha,” and “Wow.” On the other hand, “Sad” was found to be relatively neutral in valence, while “Angry” was categorized as being a negative-valence emotion (Refer to Appendix A for more details). This categorization of reaction emojis into positive- and negative-valence emotions supports my earlier proposition that AURs represented by reaction emojis will allow for a more equivalent comparison with positive-valence UGCs and negative-valence UGCs, and provide opportunities for a more accurate gauge of the opinion climate. Thus, I posit:

RQ1: What is the relative influence of UGCs and AURs on people’s perceptions of the opinion climate?

Willingness to Speak Out

Willingness to speak out is the key outcome of spiral of silence research. Noelle-Neumann (1974) conceptualized willingness to speak out as an individual's inclination to either speak out or remain silent on a controversial issue as a function of the opinion climate. Hayes (2007) criticized this conceptualization of willingness to speak out as being one-dimensional, and providing an erroneous depiction of social discourse. As a multi-faceted concept, it is inaccurate to define not speaking out as simply remaining silent as there exists a range of actions that can be adopted in its place (Hayes, 2007). Hayes (2007) also argues that communication typically adheres to social rules that govern behavior in social interactions. Conversational partners are expected to observe the rule of turn-taking, which stipulates that conversational partners are required to contribute equally to the conversation (Stivers et al., 2009). Hence, it is untenable for people to remain silent. This is further complicated by the need to maintain *face* (Goffman, 1967), where conversational partners are obligated to avoid embarrassing one another. To simultaneously address these conversational goals, people have been found to strategically engage in opinion avoidance strategies that allow them to vocalize their opinion without providing an explicit stance on the issue (Hayes, 2007). The conceptualization of willingness to speak out in terms of opinion expression and opinion avoidance corresponds to the distinction made between speaking out and speaking up (McDevitt, Kioussis, & Wahl-Jorgensen, 2005). While speaking out requires one to take an explicit stand, speaking up allows one to voice one's views without taking a particular stand. To accurately portray the intricacies of genuine social discourse, it is better to include both opinion expression and opinion avoidance in the conceptualization of willingness to speak out.

The willingness to speak out has conventionally been operationalized in terms of people's willingness to engage in public opinion expressions, either verbally through speaking out, or non-verbally through actions such as attaching badges or bumper stickers where it would be highly visible to others. To provide a more comprehensive operationalization of willingness to speak out, opinion avoidance has been included as a measure of one's willingness to speak out. For instance, instead of explicitly expressing their opinions on the issue or keeping silent, people may utilize one or a combination of the following strategies: express ambivalence, indifference, change the topic, reflect the question, or talk about someone else's opinion (Hayes, 2007). The adoption of opinion avoidance strategies was found to be more common than remaining silent (Hayes, 2007). Opinion avoidance strategies were also found to be frequently adopted in the face of an incongruent than congruent opinion climate (Hayes, 2007). As such, opinion avoidance can be regarded as a strategy undertaken by people to adhere to social rules while avoiding the threat of isolation from challenging the majority position. Thus, opinion avoidance strategies should be included in the operationalization of the willingness to speak out to more accurately depict people's responses.

In online environments, willingness to speak out was measured using available features that enable similar modes of expression as in offline environments. With the expansion and diversity of functionalities aimed at facilitating user interactivity and contribution, users can express themselves both verbally and non-verbally online. Opinion expression is typically operationalized in terms of people's willingness to verbally express themselves through comments, or non-verbally through "likes" (Gearhart & Zhang, 2015; Porten-Cheé & Eilders, 2015). With the expansion of the original "like" button to include a range of reaction emojis, this study will

operationalize opinion expression verbally (through positive-valence UGCs or negative-valence UGCs), as well as non-verbally (through positive-valence AURs including the “like” and “love” reaction emojis, and negative-valence AURs including the “sad” and “angry” reaction emojis).

An examination of the empirical studies in the spiral of silence literature also reveals that willingness to speak out has been operationalized across multiple levels of analysis, including the macrosocial, organizational, and interpersonal. Although the spiral of silence theory was initially established as a macrosocial theory of public opinion, group dynamics and interpersonal interactions have been found to play a crucial role in influencing willingness to speak out. This can be attributed to the greater ability of one’s reference group to administer punishments than a nebulous public (Scheufele & Moy, 2000). At the macrosocial level, willingness to speak out has been operationalized in terms of respondents’ willingness to engage in verbal expression such as on television or on a radio show (Noelle-Neumann, 1993; Salmon & Kline, 1985) or non-verbal expressions such as pinning on a campaign badge or pasting bumper stickers (Noelle-Neumann, 1993). At the organizational level, willingness to speak out has been operationalized in terms of speaking out in group situations such as at a social event (Neuwirth, 2000; Willnat, Lee, & Detenber, 2002) or during a group research study (Hornsey, Majkut, Terry, & McKimmie, 2003). At the interpersonal level, willingness to speak out has been operationalized in terms of one’s inclination to converse with a fellow passenger on various public modes of transportation (i.e., train, bus, taxi, airplane; Salmon & Kline, 1985). Platforms such as Facebook facilitate testing willingness to speak out across multiple levels of analysis given the range of features available that enable communication between individuals

(e.g., in private messages), within groups (e.g., closed Facebook group), and with the anonymous public (e.g., open Facebook posts).

As abovementioned, individuals' perceived congruency of their opinions with the majority opinion climate predicts their willingness to speak out. Empirical studies have provided support for this relationship (Moy, Domke, & Stamm, 2001; Scheufele et al., 2001). As such, it is reasonable to expect the perceived congruency of the opinion climate, reflected through UGCs and/or AURs on Facebook to predict willingness to speak out. Thus, I posit:

H2: People who are exposed to a congruent opinion climate will be more willing speak out about nuclear energy than people who are exposed to an incongruent opinion climate.

Source Credibility

Source credibility is a factor that has the potential to influence people's evaluations of the opinion climate and willingness to speak out, yet has been left largely unexamined. Achieving an understanding about the influence of source credibility is particularly salient in this new media age because on online and social media sites such as Facebook, the model of a single authority transmitting information has been replaced by multiple distributors via a network of peers (Madden & Fox, 2006). Given the abundance of information and the lack of gatekeepers, the responsibility of discriminating and evaluating information has fallen onto the hands of individuals. However, people typically behave as cognitive misers who lack sufficient motivation and ability to systematically process information (Chaiken & Eagly, 1989). As such, they often rely on heuristic cues as information shortcuts to evaluate the reliability of information presented (Sundar, 2008; Wirth et al., 2007). Rather than scrutinizing all elements of the message, people would focus on a few

salient features instead (Lang, 2000). A considerable amount of research has suggested that source credibility serves as a key heuristic cue to evaluate online information (Eastin, 2001; Metzger, Flanagin, & Medders, 2010). Thus, it is essential to gain an understanding of the role of source credibility in influencing perceptions and evaluations of information provided on Facebook, and how this affects people's willingness to speak out.

Source credibility is primarily judged based on the dimensions of expertise and trustworthiness. The former refers to the assessment of a communicator as being able to make correct assertions, while the latter refers to the extent to which individuals believe that the communicator can be relied upon to tell the truth (Hovland, Janis, & Kelley, 1953). Source credibility can be easily triggered by simply stating the name of the source (e.g., New York Times) on a webpage providing the content (Sundar, 2008). Likewise, it can be expected that it will be possible to activate the heuristic cue of source credibility on Facebook using features such as the profile name and profile picture of a Facebook group page.

Source credibility has been extensively studied in the persuasion and social influence literature to understand its effects on attitudes and behaviors. Extant research reveal that source credibility plays an instrumental role in persuasion and attitude formation (Pornpitakpan, 2004). Particularly, the reliance on source credibility is enhanced in the face of complex information (Callaghan & Schnell, 2009) such as nuclear energy. People were found to evaluate information sources based on the criteria of validity, relevance, saliency, and believability (Callaghan & Schnell, 2009) in the face of science information that they were unfamiliar and unknowledgeable about. Indeed, information shared by a source perceived to possess high credibility, such as scientists or policymakers, were found to be more likely to be accepted

(Hennig-Thurau et al., 2004; Siegrist & Cvetkovich, 2000). Hence, it is probable that source credibility would be among the factors influencing people's evaluation of nuclear energy-related information.

Aside from influencing attitudes, source credibility has the potential to impact people's behaviors on online and social media as well. Recent studies suggest that people were more likely to participate in online and social media interactions in the face of a source perceived to possess high credibility in comparison to a source perceived to possess low credibility. A limited body of research has attempted to examine the relationship between source credibility and speaking out on social media. These empirical studies revealed that source credibility predicted intentions to retweet (Boehmer & Tandoc Jr, 2015) and actual retweeting behavior on Twitter (Ha & Ahn, 2011). Although the feasibility of considering retweeting as a form of speaking out may be contended as some may argue that retweeting is simply an act of copying and rebroadcasting, it has been argued to constitute as a form of speaking out as users typically alter the original message by adding commentary or paraphrasing others' tweet when retweeting (boyd et al., 2010). As such, the text and the meaning of the original message is altered (boyd et al., 2010). Boehmer and Tandoc Jr (2015) also showed that retweets are often used for one of several functions including: to comment on others' tweet, to express agreement, and to validate others' expression. Thus, retweets can be considered as a method that people adopt to engage in speaking out behavior. Interestingly, many retweets were also found be utilized as a means of a call to action (e.g., to incite others to protest or donate for a cause; Boehmer & Tandoc Jr, 2015). This is particularly relevant in the case of nuclear energy adoption where people who hold strong opinions about the issue may tap on the platform in an attempt to sway public sentiments and incite action from the public. Although research related

to source credibility and speaking out behavior remains scarce, these earlier studies conducted on Twitter suggest that source credibility could possibly influence online and social media users' speaking out behavior. Following this line of argument, it can be reasonably inferred that a source perceived to possess high credibility will be able to elicit greater willingness to speak out than a source perceived to possess low credibility. Thus, I posit:

H3: People who perceive the source to possess high credibility will be more willing to speak out about nuclear energy than people who perceive the source to possess low credibility.

As posited by the spiral of silent theory, individuals will be more likely to speak out when faced with a congruent opinion climate. When exposed to persuasive arguments advanced by like-minded others who are skewed towards the same initial position, people perceive a disproportionate amount of arguments that corroborate and reinforce their initial position. Such high levels of social consensus would in turn encourage people to speak out. Earlier spiral of silence empirical research provided support for this by demonstrating the positive relationship between perceived opinion climate congruency and willingness to speak out (Moy et al., 2001; Scheufele et al., 2001). Similarly, source credibility has been claimed to affect attitudes and behaviors (Ha & Ahn, 2011; Siegrist & Cvetkovich, 2000). Thus, source credibility has the potential to encourage willingness to speak out.

Source credibility could potentially moderate the relationship between opinion climate congruency and willingness to speak out. It is probable that source credibility has a greater impact on people's willingness to speak out in a congruent opinion climate than in an incongruent opinion climate. According to the confirmation bias, people tend to disregard information that conflicts with their pre-existing attitudes

(Nickerson, 1998). This is because incongruent information creates cognitive dissonance, and this discomfort motivates people to resolve the contradiction in order to reduce their discomfort (Festinger, 1962). Thus, people will be likely to ignore dissonant information, which mutes the effect of source credibility.

On the other hand, when presented with a congruent opinion climate, people will be motivated to pay attention to such information. When people perceive themselves to share the same sentiments with a highly credible source, they will become more assured of their position and certain of their attitudes. This would heighten their willingness to speak out. However, those who perceive themselves to share the same sentiments as others who are non-credible may develop apprehension or uncertainty about their attitudes. This may dampen their willingness to speak out. Taken together, when faced with a congruent opinion climate, people who perceive the source to be more credible will be more willing to speak out than those who perceive the source to be less credible. Thus, I posit:

H4: Source credibility will moderate opinion climate congruency to affect public willingness to speak out on nuclear energy, such that people faced with a congruent opinion climate will be more likely to speak out when presented a source perceived to possess high credibility than when presented a source perceived to possess low credibility. However, source credibility would have a negligible effect on willingness to speak out when faced with an incongruent opinion climate.

CHAPTER THREE METHODS

Study Design and Participants

This study employed a 3 (Opinion cues: UGCs-only vs. AURs-only vs. UGCs-and-AURs) x 2 (Opinion climate congruency: congruent opinion climate vs. incongruent opinion climate) x 2 (Source credibility: high source credibility vs. low source credibility) between-subjects factorial design. This experimental study (embedded in the form of an online survey) was hosted on the Qualtrics Survey Software platform and engaged Research Now SSI's panel for data collection. The panel consisted of self-selected volunteers. Several demographic quotas were applied to ensure that the study population would be able to closely emulate the Singapore population. During participant recruitment, I sought to achieve an equal gender split, as well as roughly 90% Singaporeans and 10% permanent residents to more closely emulate the actual demographics of the Singapore population. I also aimed to meet the racial demographics of Singapore (75% Chinese, 12% Malay, 10% Indian, 3% Eurasian and Others). Given that this study is premised on Facebook and revolves around a national issue that involves the wider population, conducting the study through an online panel would provide greater ecological validity as it could more accurately simulate actual Facebook usage patterns and enable the recruitment of a study population that is representative of the Singapore population as compared to a sample of college students in a laboratory setting.

A sample of 360¹ current Facebook users were recruited to ensure that the participants were sufficiently familiar with the platform and its affordances to facilitate informed responses. A total of 350 participants remained after excluding the

¹ I computed the sample size needed for the experiment based on past research experience and the G*Power software. This works out to 30 participants per experimental condition, which is sufficient to account for the possibility of any unusable data.

participants who failed manipulation checks. Participants were required to be aged 21 and above, and comprised 90.6% Singaporeans and 9.4% Permanent Residents. The participants' ages ranged from 21 to 73 ($M = 34.9$, $SD = 11.3$) and consisted of 48.9% females and 51.1% males. Of the 350 participants, there were 81.4% Chinese, 10% Malays, 6.6% Indians, 0.9% Eurasians, and 1.1% Others². Upon completion, participants were remunerated with points that could be accumulated in exchange for cash vouchers.

Procedure

Participants were first screened to ensure that they are existing Facebook users. Selected participants were then directed to a pre-test questionnaire to report their Facebook usage patterns, attitude towards nuclear energy, and demographic variables. Based on their initial attitude, participants were randomly assigned to one of the twelve experimental conditions. Following this, they were exposed to the experimental stimulus, which depicted a screenshot of a Facebook group page for them to closely observe all elements on the page. Finally, the participants were directed to a post-test questionnaire which included the dependent variables and manipulation checks.

Experimental Stimulus³

A Facebook mock-up page was designed to replicate an actual Facebook page. There were twelve different stimulus pages to represent each condition. Across all conditions, intra-medium elements such as the Facebook post, profile names, and profile pictures of commenters were kept constant. Notably, the Facebook post's image and description were kept neutral in their tone to ensure that only the experimental manipulations would influence participants' perceptions of public

² Note that the sample racial statistics deviates slightly from the Singapore census.

³ Refer to Appendix B for the twelve experimental conditions that participants were exposed to.

opinion regarding nuclear energy. Participants viewed a neutral tone article posted on the Facebook group entitled “Should Singapore adopt nuclear energy?” Below this title, participants viewed a snippet of an article that elaborated on the advantage and disadvantage of nuclear energy adoption.

User-generated comments. A total of four positive-valence UGCs or four negative-valence UGCs in response to the article were displayed below the main post. The UGCs were gathered from actual responses to nuclear-related topics across various online and social media posts to enhance ecological validity. A pilot test was administered on 42 Research Now SSI panel members in August 2018 to shortlist four positive-valence UGCs and four negative-valence UGCs to be included in the stimulus. An example of a positive-valence UGC is “Even with all its potential drawbacks, nuclear energy is still a better energy option as compared to other sources of energy such as burning coal or furnace oil power stations.” An example of a negative-valence UGC is “Definitely a NO. If anything happened, there will not be any place to run to. The whole country will be wiped out instantly and Singapore will become a vacant land.” (Refer to Appendix C for the full list of items). All the UGCs contained the same number of words (i.e., 30 words) to ensure that there were no biases resulting from the length of the UGCs.

Aggregated user representations. A total of two types of positive-valence AURs or two types of negative-valence AURs in response to the article were displayed below the main post. A pilot test was administered on 42 Research Now SSI panel members in August 2018 to select the reaction emojis that elicited perceptions of a supportive or unsupportive opinion climate. The findings from the pilot test corroborated with the valence and intensity of emotions as stated in the Emoji Sentiment Ranking, with the exception of the “sad” reaction emoji which was rated as

negative-valence rather than neutral. Taking into account the Emoji Sentiment Ranking scores and findings from the pilot test, positive-valence AURs were reflected by a high number of “like” and “love” reaction emojis, while negative-valence AURs were reflected by a high number of “sad” and “angry” reaction emojis. The number of reaction emojis in the AURs-only and UGCs-and-AURs conditions were determined based on results from the pilot test and a random number generator, and was kept constant across all conditions containing AURs.

Source credibility. Source credibility was elicited through the name and profile picture of a Facebook group page. A pilot test was conducted with 42 Research Now SSI panel members in August 2018 to determine the potential stakeholders that were perceived as possessing high source credibility or low source credibility for the topic of nuclear energy. Drawing on the pilot test findings, the high source credibility conditions reflected a Facebook group by the World Health Organization, while the low source credibility conditions reflected a Facebook group by laypeople.

Measures

Attitude towards nuclear energy. Attitude towards nuclear energy was assessed on a 6-point Likert scale (1 = *strongly disagree*, 6 = *strongly agree*) for the statement “I support the adoption of nuclear energy in Singapore.” Higher scores indicate greater support for nuclear energy adoption ($M = 3.18$, $SD = 1.45$).

Willingness to speak out. Willingness to speak out was measured in terms of both opinion expression and opinion avoidance using scales adapted from past studies (Gearhart & Zhang, 2015; Hayes, 2007). Willingness to speak out was measured on a 7-point Likert scale (1 = *very unlikely*, 7 = *very likely*) by the following items: “I am willing to (a) argue for my position, (b) provide a neutral comment on the post, (c) talk about the opinion of someone else (d) pretend to agree with the majority (e) click the

‘like’ reaction emoji, (f) click the ‘love’ reaction emoji, (g) click the ‘sad’ reaction emoji, and (h) click the ‘angry’ reaction emoji.” Reliability test demonstrated an acceptable level of internal consistency (Cronbach’s $\alpha = 0.73$). Therefore, the eight items were averaged to form a composite scale, with higher scores indicating higher levels of willingness to speak out ($M = 3.43$, $SD = 1.73$).

Perceptions of the opinion climate. Perceptions of the opinion climate was measured using five items on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*) adapted from Neubaum and Krämer (2017). The items utilized include (a) “People in this Facebook group are supportive of nuclear energy,” (b) “My family is supportive of nuclear energy,” (c) “My friends are supportive of nuclear energy,” (d) “Singaporeans are supportive of nuclear energy,” and (e) “Singaporeans will be supportive of nuclear energy over the next 10 years.” Reliability test reflected a high level of internal consistency (Cronbach’s $\alpha = 0.90$). Therefore, the five items were averaged to form a composite scale, with higher scores indicating higher levels of support for nuclear energy ($M = 3.43$, $SD = 1.68$).

Manipulation Checks

Opinion cues. The amount of attention paid to the UGCs and AURs was tested by the question “Which of the following did you view earlier?” and participants were provided four possible answers: user-generated comments, reaction emojis, both, or I did not notice. Participants who selected the option ‘I did not notice’ were excluded from the analysis. Data from the participants who answered incorrectly were excluded from the analysis.

Source credibility. Source credibility was measured using six items on a 7-point semantic-differential scale adapted from Ohanian (1990). Source credibility was assessed by the statement “Overall, I find the Facebook post to be: (a) Trustworthy–

Untrustworthy, (b) Unbiased–Biased, (c) Reliable–Unreliable, (d) Expert–Non-expert, (e) Qualified–Unqualified, and (f) Experienced–Inexperienced.” Reliability test demonstrated a high level of internal consistency (Cronbach’s $\alpha = 0.95$). Hence, the six items were averaged to form a composite scale, with lower scores indicating higher levels of perceived source credibility of the Facebook group ($M = 4.04$, $SD = 1.71$). The correct answer was dependent on whether participants were assigned to a high credibility or low credibility condition. Data from the participants who responded wrongly were excluded from the analysis.

Splitting of Groups

Participants were allocated to either a congruent opinion climate or incongruent opinion climate condition based on their initial self-reported attitude towards nuclear energy in the pre-test questionnaire. Although it is possible to examine opinion climate congruency as a continuous variable, in the spiral of silence literature, scholars are typically interested to understand the impact of opinion congruence and opinion incongruence rather than degree of congruence on the dependent variables. To examine the impact of opinion cues and opinion climate congruency on perceptions of the opinion climate, participants were further subdivided based on their initial self-reported attitudes (i.e., pro-nuclear energy or anti-nuclear energy) for data analysis. In response to the question “I support the adoption of nuclear energy in Singapore,” those who indicated “4 = *mildly agree*,” “5 = *agree*,” or “6 = *strongly agree*” were taken to be pro-nuclear energy. Those who indicated “1 = *strongly disagree*,” “2 = *disagree*,” or “3 = *mildly disagree*” were taken to be anti-nuclear energy. Four groups emerged based on this method of participant allocation (refer to Table 1). Group 1 consisted of pro-nuclear energy participants that were allocated to a congruent condition. Group 2 consisted of anti-nuclear energy

participants that were allocated to a congruent condition. Group 3 consisted of pro-nuclear energy participants that were allocated to an incongruent condition. Group 4 consisted of anti-nuclear energy participants that were allocated to an incongruent condition.

[Insert Table 1 about here.]

CHAPTER FOUR RESULTS

I conducted a two-way between-subjects analysis of variance (ANOVA) to answer H1a, H1b, H1c, and RQ1 (refer to Table 2). I sought to examine the influence of two independent variables (opinion cues and opinion climate congruency) on the dependent variable (perceptions of the opinion climate). Opinion cues consisted of three groups (UGCs-only, AURs-only, or UGCs-and-AURs) and opinion climate congruency comprised four groups (Group 1: pro-nuclear energy participants who were allocated to a congruent opinion climate; Group 2: anti-nuclear energy participants who were allocated to a congruent opinion climate; Group 3: pro-nuclear energy participants who were allocated to an incongruent opinion climate; Group 4: anti-nuclear energy participants who were allocated to an incongruent opinion climate). The results for the two-way ANOVA indicated that there was no significant effect for opinion cues [$F(2,338) = 2.68, n.s.$]. However, there was a significant main effect for opinion climate congruency [$F(3, 338) = 110.5, p < .001, \text{partial } \eta^2 = .50$] (see Figure 1). There was also a significant interaction effect between opinion cues and opinion climate congruency [$F(6, 338) = 8.18, p < .001, \text{partial } \eta^2 = .13$] (see Figure 2).

[Insert Table 2 about here.]

H1a predicted that participants exposed to a congruent UGCs-only condition would perceive the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent UGCs-only condition. Post-hoc analysis using the Tukey HSD test was conducted to determine such effects. Among pro-nuclear energy participants, those exposed to a congruent UGCs-only condition ($M = 4.91, SD = .90$) perceived the opinion climate to be more supportive of nuclear energy than participants exposed to an incongruent UGCs-only condition ($M = 3.20,$

$SD = .1.22$). Among anti-nuclear energy participants, those exposed to a congruent UGCs-only condition ($M = 1.91$, $SD = .85$) perceived the opinion climate to be more unsupportive of nuclear energy than participants exposed to an incongruent UGCs-only condition ($M = 3.83$, $SD = 0.95$). Thus, H1a was supported.

H1b posited that participants exposed to a congruent AURs-only condition would perceive the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent AURs-only condition. Post-hoc analysis using the Tukey HSD test was conducted to determine such effects. The results reflected that among pro-nuclear energy participants, those exposed to a congruent AURs-only condition ($M = 4.65$, $SD = .97$) perceived the opinion climate to be more supportive of nuclear energy than participants exposed to an incongruent AURs-only condition ($M = 4.00$, $SD = 1.06$). Among anti-nuclear energy participants, those exposed to a congruent AURs-only condition ($M = 2.88$, $SD = 1.09$) perceived the opinion climate to be more unsupportive of nuclear energy than participants exposed to an incongruent AURs-only condition ($M = 3.01$, $SD = 1.04$). Thus, H1b was supported.

H1c postulated that participants exposed to a congruent UGCs-and-AURs condition would perceive the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent UGCs-and-AURs condition. Post-hoc analysis using the Tukey HSD test was conducted to determine such effects. Among pro-nuclear energy participants, those exposed to a congruent UGCs-and-AURs condition ($M = 5.01$, $SD = .83$) perceived the opinion climate to be more supportive of nuclear energy than participants exposed to an incongruent UGCs-and-AURs condition ($M = 2.96$, $SD = 1.16$). Among anti-nuclear energy participants, those exposed to a congruent UGCs-and-AURs condition ($M = 1.66$, $SD = 0.75$)

perceived the opinion climate to be more unsupportive of nuclear energy than participants exposed to an incongruent UGCs-and-AURs condition ($M = 3.66$, $SD = 1.00$). Thus, H1c was supported.

RQ1 sought to explore the relative influence of UGCs and AURs on perceptions of the opinion climate. This was achieved by conducting a post-hoc analysis of the two-way ANOVA using the Tukey HSD test. Among group 1 participants (pro-nuclear energy participants who were allocated to a pro-nuclear condition), there were no significant differences in perceptions of the opinion climate among participants exposed to the UGCs-only condition ($M = 4.91$, $SD = .90$), AURs-only condition ($M = 4.65$, $SD = .97$), or UGCs-and-AURs condition ($M = 5.01$, $SD = .83$, *n.s.*).

Among group 2 participants (anti-nuclear energy participants who were allocated to an anti-nuclear energy condition), those exposed to the UGCs-only condition ($M = 1.91$, $SD = .85$) perceived the opinion climate to be more unsupportive of nuclear energy than those exposed to the AURs-only condition ($M = 2.88$, $SD = 1.09$, $p < .001$). Similarly, participants exposed to the UGCs-and-AURs condition ($M = 1.66$, $SD = .75$) perceived the opinion climate to be more unsupportive of nuclear energy than those exposed to the AURs-only condition ($M = 2.88$, $SD = 1.09$, $p < .001$). However, there was no significant difference in perceptions of the opinion climate among participants in the UGCs-only condition ($M = 1.91$, $SD = .85$) and participants in the UGCs-and-AURs condition ($M = 1.66$, $SD = .75$, *n.s.*).

Among group 3 participants (pro-nuclear energy participants who were allocated to an anti-nuclear energy condition), those exposed to the UGCs-only condition ($M = 3.20$, $SD = 1.22$) perceived the opinion climate to be more unsupportive of nuclear energy than those exposed to the AURs-only condition ($M =$

4.00, $SD = 1.06$, $p < .05$). Similarly, participants who were exposed to the UGCs-and-AURs condition ($M = 2.96$, $SD = 1.16$) perceived the opinion climate to be more unsupportive of nuclear energy than those exposed to the AURs-only condition ($M = 4.00$, $SD = 1.06$, $p < .05$). However, there was no significant difference in perceptions of the opinion climate among participants in the UGCs-only condition ($M = 3.20$, $SD = 1.22$) and participants in the UGCs-and-AURs condition ($M = 2.96$, $SD = 1.16$, $n.s.$).

Among group 4 participants (anti-nuclear energy participants who were allocated to a pro-nuclear energy condition), those exposed to the UGCs-only condition ($M = 3.83$, $SD = .95$) perceived the opinion climate to be more supportive of nuclear energy than those exposed to the AURs-only condition ($M = 3.01$, $SD = 1.04$, $p < .01$). Similarly, participants exposed to the UGCs-and-AURs condition ($M = 3.66$, $SD = 1.00$) perceived the opinion climate to be more supportive of nuclear energy than those exposed to the AURs-only condition ($M = 3.01$, $SD = 1.04$, $p < .05$). However, there was no significant difference in perceptions of the opinion climate among participants in the UGCs-only condition ($M = 3.83$, $SD = .95$) and participants in the UGCs-and-AURs condition ($M = 3.66$, $SD = 1.0$, $n.s.$).

I conducted a second two-way ANOVA to address H2, H3, and H4 (refer to Table 3). I investigated the influence of two independent variables (opinion climate congruency and source credibility), on the dependent variable (willingness to speak out). Opinion climate congruency comprised two groups (congruent opinion climate and incongruent opinion climate) and source credibility consisted of two groups (high source credibility and low source credibility). The results for the two-way ANOVA indicated that there was no significant effect for opinion climate congruency [$F(1, 346) = .72$, $n.s.$]. However, there was a significant main effect for source credibility [$F(1, 346) = 11.08$, $p < .01$, partial $\eta^2 = .03$] (see Figure 3). There was also a

significant interaction effect between source credibility and opinion climate congruency [$F(1, 346) = 4.02, p < .05, \text{partial } \eta^2 = .01$] (see Figure 4).

[Insert Table 3 about here.]

H2 predicted that participants who were exposed to a congruent condition would be more willing to speak out about nuclear energy than people who were exposed to an incongruent condition. However, there was no significant effect was found between opinion climate congruency and willingness to speak out [$F(1, 346) = .72, n.s.$]. Thus, H2 was not supported.

Due to the non-significant association found between opinion climate congruency and willingness to speak out, I conducted a post-hoc analysis that examined perceptions of the opinion climate as a mediator between opinion climate congruency and willingness to speak out (see Figure 5). I utilized model 4 of the PROCESS macro (Hayes, 2013) to analyze the mediation effects. The mediation test was based on 10,000 bootstrap samples and a 95% bias-corrected confidence intervals. The findings showed a significant relationship between the independent variable (opinion climate congruency) and mediator (perceptions of the opinion climate), $b = .29, t(348) = 4.16, p < .001$. There was also a significant relationship between the mediator (perceptions of the opinion climate) and dependent variable (willingness to speak out), $b = .20, t(347) = 5.38, p < .001$. The results also demonstrated a significant total effect of perceptions of the opinion climate (mediator) and opinion climate congruency (independent variable) on willingness to speak out (dependent variable). In this model, perceptions of the opinion climate (mediator) was significantly associated with willingness to speak out (dependent variable), $b = .20, t(347) = 5.38, p < .001$. On the other hand, opinion climate congruency (independent variable) was not significantly associated with willingness to speak out (dependent variable), $b = .02,$

$t(347) = .41, p > .05$. These findings will be discussed in further detail in the Discussion section.

H3 posited that participants who perceived the source to possess high credibility will be more willing to speak out about nuclear energy than people who perceived the source to possess low credibility. The results for the two-way ANOVA indicated a significant main effect between source credibility and willingness to speak out [$F(1, 346) = 11.08, p < .01$, partial $\eta^2 = .03$]. In line with what was posited, participants who perceived the source to possess high credibility ($M = 3.60, SD = .08$) were found to be more willing to speak out on nuclear energy than participants who perceived the source to possess low credibility ($M = 3.24, SD = .08$; see Figure 3). Thus, H3 was supported.

H4 postulated that source credibility will moderate opinion climate congruency to influence willingness to speak out. The two-way ANOVA showed that there was a significant interaction effect between opinion climate congruency and source credibility on willingness to speak out [$F(1, 346) = 4.02, p < .05$, partial $\eta^2 = .01$]. The findings revealed that when participants were faced with an incongruent opinion climate, there was a negligible difference in their willingness to speak out regardless of whether they were in the high source credibility ($M = 3.39, SD = 1.01$) or low source credibility condition ($M = 3.53, SD = .96$). On the other hand, when faced with a congruent opinion climate, participants in the high source credibility condition ($M = 3.66, SD = .98$) were significantly more willing to speak out than participants in the low source credibility condition ($M = 3.08, SD = 1.06$; see Figure 4). Thus, H4 was supported.

CHAPTER FIVE DISCUSSION

This study has yielded important findings about online public opinion and the SOS theory. First, the results showed that the use of reaction emojis to represent AURs provided a more accurate depiction of the opinion climate in comparison to a high or low number of likes. Second, source credibility was found to influence SOS effects, with higher levels of source credibility being positively associated with willingness to speak out. Third, source credibility moderated opinion climate congruency to affect willingness to speak out. That is, people were more willing to speak out when supported by a congruent opinion climate and a highly credible source than when faced with either an incongruent opinion climate and/or a less credible source.

This study offers conceptual contribution, in terms of understanding whether and how some of the SOS's assumptions hold up in the online and social media environment with unique affordances. It extended upon and mitigated the shortcomings of earlier research designs by including reaction emojis in the assessment of AURs as an indicator of public opinion, as well as using a Facebook post that contained an image and description that is neutral in tone to ensure that participants' perceptions of the opinion climate will not be confounded by the stimulus aside from the manipulated factors. Moreover, this is the pioneer study to examine the effect of source credibility in conjunction with the SOS theory

Influence of Opinion Cues on Perceptions of the Opinion Climate

The findings provide support for H1a, as participants exposed to a congruent UGCs-only condition perceived the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent UGCs-only condition. That is, participants who initially expressed support for nuclear energy, and were later exposed to a pro-nuclear energy condition perceived the opinion climate to

be more supportive of nuclear energy than participants who were exposed to an anti-nuclear energy condition. Likewise, participants who initially expressed opposition towards nuclear energy, and were later exposed to an anti-nuclear energy condition perceived the opinion climate to be more unsupportive of on nuclear energy than participants who were exposed to a pro-nuclear energy condition. These findings were in line with earlier research (Lee & Jung, 2010; Neubaum & Krämer, 2017) and attests to the role of UGCs in influencing perceptions of the opinion climate.

The findings provide support for H1b, as participants exposed to a congruent AURs-only condition perceived the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent AURs-only condition. Among pro-nuclear energy participants, those exposed to a pro-nuclear energy condition perceived the opinion climate to be more supportive of nuclear energy than participants exposed to an anti-nuclear energy condition. Among anti-nuclear energy participants, those exposed to an anti-nuclear energy condition perceived the opinion climate to be more unsupportive of nuclear energy than participants exposed to a pro-nuclear energy condition. This suggests that AURs with the inclusion of reaction emojis affected people's perceptions of the opinion climate. These findings contrasted with the negligible effects of AURs found in earlier studies (Lee & Jung, 2010; Neubaum & Krämer, 2017), and support my argument that AURs with the inclusion of reaction emojis (e.g., "like," "love," "sad," and "angry") can mitigate the absence of polarity of AURs in earlier research (i.e., high number of "likes: vs. low number of "likes") to more accurately reflect the opinion climate. This also suggests that positive-valence and negative-valence AURs serve as more equivalent comparisons with positive-valence and negative-valence UGCs, and should be examined in future studies.

The findings provide support for H1c, as participants exposed to a congruent UGCs-and-AURs condition perceived the opinion climate to be more supportive of their view on nuclear energy than participants exposed to an incongruent UGCs-and-AURs condition. Among pro-nuclear energy participants, those exposed to a pro-nuclear energy condition perceived the opinion climate to be more supportive of nuclear energy than participants exposed to an anti-nuclear energy condition. Among anti-nuclear energy participants, those exposed to an anti-nuclear energy condition perceived the opinion climate to be more unsupportive of nuclear energy than participants exposed to a pro-nuclear energy condition. These results support the findings from an earlier study that demonstrated the joint effect of UGCs and AURs on people's attitudes (Hu et al., 2014) and highlight the importance of including both positive-valence and negative-valence UGCs and AURs when making comparisons between the effects of both types of opinion cues. These findings also highlight the importance of assessing both types of opinion cues when attempting to determine perceptions of the online and social media opinion climate.

Overall, across the UGCs-only, AURs-only, as well as UGCs-and-AURs conditions, the congruency of the opinion climate was found to influence participants' perceptions of the opinion climate regarding nuclear energy. These findings corroborate with the argument that users are made cognizant of other's attitudes toward an issue through opinion cues on online and social media, and generalize them to be representative of public opinion (Brosius, 1999; Sonck & Loosveldt, 2010; Zerback et al., 2015). This shows that people perceive the online opinion climate through different opinion cues and underscores the importance of examining both types of opinion cues in the investigation of perceptions of the opinion climate.

Relative Influence of UGCs and AURs on Perceptions of the Opinion Climate

In response to RQ1, the findings demonstrate that social media users tap on both types of opinion cues to monitor the opinion climate. Yet, while both UGCs and/or AURs affected perceptions of the opinion climate, it is important to note that participants' perceptions of the opinion climate were more strongly influenced by UGCs-only, and UGCs-and-AURs, than AURs-only. For instance, group 2 participants (anti-nuclear energy participants placed in an anti-nuclear energy condition) perceived the opinion climate to be more unsupportive of nuclear energy when exposed to a UGCs-only condition or UGCs-and-AURs condition than when exposed to an AURs-only condition. Similarly, group 3 participants (pro-nuclear energy participants placed in an anti-nuclear energy condition) perceived the opinion climate to be more unsupportive of nuclear energy when exposed to a UGCs-only condition or both UGCs-and-AURs condition than when exposed to an AURs-only condition. Group 4 participants (anti-nuclear energy participants placed in a pro-nuclear energy condition) were likewise found to perceive the opinion climate to be more supportive of nuclear energy when exposed to a UGCs-only condition or UGCs-and-AURs condition than when exposed to an AURs-only condition.

These findings are in line with earlier arguments that the personal nature and vividness of UGCs make them easier to grasp than the impersonal base-rate descriptions of AURs (Mutz, 1998). As people tend to lack the motivation and ability to process information, UGCs allow them to tap on their representativeness heuristics to form opinions and judgments (Tversky & Kaheman, 1973). Indeed, earlier empirical studies have found that exemplars play a greater role in affecting people's perceptions of the opinion climate than statistical information (Brosius, 1999; Brosius & Bathelt, 1994). This suggests that UGCs may be superior to AURs in influencing

perceptions of the opinion climate and affecting public opinion. Additionally, the lack of significant difference between the UGCs-only condition and UGCs-and-AURs condition suggests that UGCs-only and UGCs-and-AURs function in a similar manner to affect perceptions of the opinion climate. Alternatively, it is possible that in the face of both types of opinion cues, audiences may pay more attention to UGCs than AURs. It is worthwhile for future studies to examine both types of opinion cues that are of contrasting valence (e.g., positive-valence UGCs and negative-valence AURs, or vice versa) to determine such effects.

Opinion Climate Congruency on Willingness to Speak Out

The findings did not provide support for H2, as there was no significant main effect of opinion climate congruency on willingness to speak out about nuclear energy. Although opinion climate congruency did not have a direct effect on willingness to speak out, perceptions of the opinion climate was found to mediate the relationship between opinion climate congruency and willingness to speak out. Put simply, people were more willing to speak out in the face of a congruent opinion climate if they are able to accurately perceive the opinion climate to be in line with their position on the issue. This finding is in line with the arguments put forth by Bodor (2012) that individuals may be limited in their ability to estimate the extent of dissonance between one's own position and the perceived broader opinion climate, which in turn make it difficult to influence speaking out behavior. Noelle-Neumann and Petersen (2004) have also criticized the operationalization of opinion climate congruency on theoretical grounds, arguing that perceptions of the opinion climate occur on an unconscious level. In this regard, congruity measures are invalid, because if perceptions of the opinion climate were to occur through an unconscious process, individuals are unaware of whether they are congruent with the dominant position.

Yet, the measure of opinion climate congruency remains as a necessary and crucial measure of the spiral of silence as it helps researchers to identify the perceived majority position that is influencing public opinion in a public controversy (Noelle-Neumann & Petersen, 2004). All in all, this suggests that although opinion climate congruency is a necessary factor influencing willingness to speak out, there may be other mechanisms and factors at play that could attenuate or enhance its impact.

The non-significant main effect of opinion climate congruency on willingness to speak out is also not surprising in light of the weak empirical support found for this relationship in extant research. Some studies found mixed results for the effect of opinion climate congruency on speaking out behavior (Salmon & Neuwirth, 1990), while others found contradictory results (i.e., people spoke out despite being exposed to an incongruent opinion climate; McDevitt et al., 2003). A meta-analysis conducted by Glynn, Hayes, and Shahanan (1997) illustrates that perceived opinion climate congruency and willingness to speak out is statistically significant. However, the average effect size is weak. This suggests that the significant findings could be attributed to measurement error, or that opinion climate congruency may simply be one of the many factors influencing willingness to speak out, and contingent on other factors. Other scholars have distinguished between current opinion climate congruency and future opinion climate congruency, arguing that the latter takes precedence in influencing people's inclination to speak out (Neuwirth, 2000; Salmon & Neuwirth, 1990; Scheufele et al., 2001). Moreover, scholars have proposed that alternative mediating or moderating mechanisms such as issue salience (Salmon & Neuwirth, 1990), attitude certainty (Matthes, Morrison, & Schemer, 2010), or power distance could influence speaking out behavior.

Source Credibility on Willingness to Speak Out

The findings provide support for H3, as participants who perceived the source to possess high credibility were found to be more willing to speak out about nuclear energy than people who perceived the source to possess low credibility. This is an important discovery as it is the first study to provide empirical support for the influence of source credibility on willingness to speak out. To elaborate, people were more willing to speak out when faced with a source perceived to possess high credibility than when faced with a source perceived to possess low credibility. This finding is consistent with existing research that showed the crucial role that source credibility plays in persuasion, attitude formation, and behavioral intention (Hennig-Thurau et al., 2004; Hovland & Welsh, 1951; Siegrist & Cvetkovich, 2000). The significant relationship between source credibility and willingness to speak out also supports the claim that people tend to accept information shared by those perceived to possess the qualities of expertise and trustworthiness, which in turn emboldens them to speak out. This finding generates important insight on the role of source credibility in the spiral of silence literature.

Source Credibility as a Moderator

The results provide support for H4, as source credibility was shown to serve as a moderator for opinion climate congruency and willingness to speak out. To elaborate, when faced with a congruent opinion climate, people were more willing to speak out when their position is corroborated by a source perceived to possess high credibility than a source perceived to possess low credibility. Such findings are unsurprising, as people who perceive their views as being supported by a source that is highly credible would likely become more certain of their view, which would in turn boost their willingness to speak out. On the other hand, when faced with congruent

opinion climate by a source that possess low credibility, people may be apprehensive or develop doubts about their initial position, which stifles their willingness to speak out.

On the contrary, when faced with an incongruent opinion climate, source credibility had a negligible impact on people's willingness to speak out. This is in line with the confirmation bias, which states that people tend to ignore information that conflicts with their pre-existing beliefs or attitudes. Following this line of argument, people would disregard information presented in the incongruent condition. As such, the credibility of the source would not have an impact on their willingness to speak out.

Theoretical and Practical Implications

This study provides important theoretical implications for the spiral of silence theory by illuminating how social media users perceive the online and social media opinion climate. The findings showed that people pick up on new modes of expression in the evolving media environment to perceive and evaluate the opinion climate. This highlights the importance for future research to assess both UGCs and/or AURs with the inclusion of reaction emojis in their study of online spiral of silence effects. Additionally, although both types of opinion cues were found to influence perceptions of the opinion climate, the impact of UGCs were found to supersede that of AURs. More research is required to understand how people perceive the different opinion cues, and whether there are different motivations driving people's choice of UGCs and/or AURs in speaking out.

These findings also have important practical implications for policymakers and science communicators, as it emphasizes the significant influence of both verbal and non-verbal forms of speaking out on perceptions of public opinion. This points to a

need for policymakers to monitor and regulate subversive online behavior that attempt to influence public opinion regarding issues of national significance, such as nuclear energy adoption.

This study also made an important contribution by ascertaining the effect of source credibility on willingness to speak out. These findings provide important implications for the spiral of silence literature, as it highlights the need to consider source credibility as a factor influencing willingness to speak out. The role of source credibility is particularly salient in the online and social media context that is based on subjective opinions rather than objective facts due to the lack of journalistic gatekeeping. As social media popularity continues to gain prominence, it is probable that people's reliance on the online opinion climate to determine public opinion may supersede that of the offline opinion climate. Thus, it is imperative to identify other factors influencing public opinion in the online and social media environment in future spiral of silence research.

This finding also has important implications for practitioners, as it emphasizes the importance of source credibility of spokesperson for the communication and transmission of unfamiliar and specialized science information and opinions in the online media environment. Future research should explore whether perceptions of source credibility varies across different social media platforms, such that content on one platform may be perceived to be more credible than another. For instance, it is common for politicians or scientists to reach out to the public through Facebook and Twitter. However, such outreach efforts remain scarce on platforms such as Instagram or YouTube. It would also be interesting to investigate which platform features are best able to elicit perceptions of source credibility (e.g., number of Instagram

followers, number of subscribers on YouTube, number of mentions and retweets on Twitter).

Limitations and Future Research

In spite of its theoretical contributions to extant research and practical contributions to the field of public opinion, this study contains several limitations. First, this study relied on data collected from an online survey panel. This research design could have limited the generalizability of the findings as the self-selected nature of online panel participants may be skewed towards a specific demographic. However, quotas were enforced to ensure that the study population more closely reflected Singapore's demographics. Moreover, this study is only interested in examining the Facebook population. Hence, an experiment (embedded in an online survey) would provide greater ecological validity by allowing participants to view and interact with the Facebook experimental stimulus in a similar manner as they would in a natural setting.

Second, this study manipulated the opinion climate in terms of either a positive-only or a negative-only opinion climate. However, the diverse opinions on social media often result in a mixed opinion climate with regard to various issues. A single comment thread on a Facebook post typically presents various viewpoints regarding the same issue; while some may express support, others may express opposition. Likewise, a single Facebook post often contain a mix of positive-valence, negative-valence, or neutral-valence UGCs and/or AURs. It is important to understand how this may influence people's perceptions of the opinion climate and their willingness to speak out. With mixed opinions, it is also possible that users may perceive source credibility in terms of the individual instead of the Facebook group as a whole to form or alter their opinions. Moreover, mixed opinion climate conditions

(e.g., positive-valence UGCs and negative-valence AURs, or negative-valence UGCs and positive-valence AURs) will be more meaningful for comparisons among the UGCs-only, AURs-only, and UGCs-and-AURs conditions to determine the relative impact of different opinion cues on perceptions of the opinion climate. That is, to determine which opinion cue would have a greater impact on perceptions of the opinion climate. Future research should delve into how mixed opinion climates and the relative impact of different opinion cues influence perceptions and evaluations of the opinion climate to inhibit or exacerbate the spiral of silence effect.

Third, this study utilized Facebook to make generalizations to the way public opinion manifests on online and social media platforms. Facebook was selected due to its established prominence and popularity in comparison to other social media sites (Fiegerman, 2017). However, due to the selected approach, there is a need to treat the generalizability of the results with caution. Future studies should examine whether the intended effects pan out in a similar manner on other online and social media platforms such as Instagram, Twitter, or YouTube. These platforms share multiple commonalities with Facebook, yet vary in terms of their channel affordances. For instance, on YouTube, AURs are reflected in the form of the “thumbs up” or “thumbs down” button that may be limited in its ability to express the emotionality of facial expressions made possible through reaction emojis. On Twitter, AURs are only available through the “heart” buttons, without the functionality to express negative emotions. Thus, users may perceive the opinion climate using alternative opinion cues such as the number of retweets. Future studies should examine how the unique affordances and features on alternative social media platforms may influence the process of monitoring and expressing opinions across different social media platforms.

It is also worthwhile for future studies to conduct a longitudinal study to illuminate the dynamic nature of opinion trends on social media as the majority of existing studies rely on cross-sectional data to examine spiral of silence effects. This can be achieved through tapping on big data analyses that will allow researchers to obtain behavioral data over an extended period that will be able to more accurately demonstrate the spiraling process. This data can be used to complement survey or experimental findings to assess people's willingness to speak out on traditional and new media platforms. The use of automated analyses could also potentially alleviate the shortcomings of self-reported measures to provide a more precise understanding of the social-psychological mechanisms underlying online public opinion.

Conclusion

Summing up, this study has shed light on the way people perceive and evaluate the online opinion climate regarding controversial science issues. By testing the effect of AURs with the inclusion of reaction emojis, this study advanced the emerging body of literature that sought to examine how opinion cues influence the way people monitor the opinion climate in the contemporary media environment. This thesis also introduced an alternative way to understand public expression of opinions by illuminating the role of source credibility on willingness to speak out. The findings have helped to further online public opinion research and the spiral of silence theory by illuminating how novel affordances and unique features prevalent on social media affect the formation of public opinion.

Policymakers and science communicators can draw on these conceptual contributions to develop an understanding of the process through which public opinion manifests. This can in turn aid them in implementing and maximizing the effectiveness of communication strategies. Researchers should extend upon this study

to attain an in-depth understanding of, and identify additional factors that can emerge from social media platforms to impact public opinion and people's willingness to speak out.

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APPENDICES

Appendix A

Sentiment Analysis of Emojis

Emoji label	Emoji	Corresponding Facebook reaction emoji	Sentiment score [-1.... +1]
Like			.521
Love			.746
Haha			.409
Wow			.269
Sad			.007
Angry			-.299

Note: Although the sentiment score for the sad reaction emoji based on the Emoji Sentiment Ranking was relatively neutral, the pilot test conducted indicates that respondents rated it as negative-valence.

Appendix B

Experimental Stimulus

B1. Condition: Congruent (Positive)⁴, UGCs-only, high credibility

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Michelle Lim Some of the newer nuclear technology are really promising, and much less dangerous than we imagine. It may be the most efficient way to create energy and shouldn't be overlooked.
Like · Reply · 11 hrs

Aisha Bin Ahmed Nuclear sources of radiation are not exclusively used for power generation only. We see it in nuclear medicine. We see it in some measurement instruments. Radiation is with us today.
Like · Reply · 10 hrs

Ryan Lee Cutting pollution and reducing millions of premature deaths annually through the burning of fossil fuels is a good enough reason for me to pursue a sustainable path towards alternative technologies.
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⁴ These labelling assume that participants are supportive of nuclear energy adoption.

B2. Condition: Congruent (Positive), UGCs-only, low credibility

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Ryan Lee Cutting pollution and reducing millions of premature deaths annually through the burning of fossil fuels is a good enough reason for me to pursue a sustainable path towards alternative technologies.
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B3. Condition: Incongruent (Negative), UGCs-only, high credibility

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Michelle Lim Should a nuclear plant disaster occur in Singapore, this small island will be turned into a vacant land, not fit for humans to live in, for a very long time.

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Aisha Bin Ahmed The repercussions of a nuclear fallout are widespread. They're not only detrimental to us but our neighbouring countries too. This is a catastrophe we can ill afford to gamble with.

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Ryan Lee Just remember that we are a small country and if a meltdown ever happens, we will either all die instantly or die slowly, some may be lucky to become mutants.

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Aisha Bin Ahmed Nuclear sources of radiation are not exclusively used for power generation only. We see it in nuclear medicine. We see it in some measurement instruments. Radiation is with us today.

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Ng Jia Hao Definitely a NO. If anything happened, there will not be any place to run to. The whole country will be wiped out instantly and Singapore will become a vacant land.
[Like](#) · [Reply](#) · 15 hrs

Michelle Lim Should a nuclear plant disaster occur in Singapore, this small island will be turned into a vacant land, not fit for humans to live in, for a very long time.
[Like](#) · [Reply](#) · 11 hrs

Aisha Bin Ahmed The repercussions of a nuclear fallout are widespread. They're not only detrimental to us but our neighbouring countries too. This is a catastrophe we can ill afford to gamble with.
[Like](#) · [Reply](#) · 10 hrs

Ryan Lee Just remember that we are a small country and if a meltdown ever happens, we will either all die instantly or die slowly, some may be lucky to become mutants.
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Ng Jia Hao Definitely a NO. If anything happened, there will not be any place to run to. The whole country will be wiped out instantly and Singapore will become a vacant land.

Like · Reply · 15 hrs

Michelle Lim This is a really bad and stupid idea, I have 1 question, wouldn't it be an easy target during a war? Making it easy for enemy to wipe us out?

Like · Reply · 11 hrs

Aisha Bin Ahmed Two of the world's most technologically advanced nations, Japan and Germany, are both retreating from nuclear power. Why is Singapore not learning from their lessons? Cheaper is not always better.

Like · Reply · 10 hrs

Ryan Lee Just remember that we are a small country and if a meltdown ever happens, we will either all die instantly or die slowly, some may be lucky to become mutants.

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Appendix C

Positive and Negative UGCs

SN	Valence of comment	Comment
1	Positive	"Even with all its potential drawbacks, nuclear energy is still a better energy option as compared to other sources of energy such as burning coal or furnace oil power stations."
2	Positive	"Some of the newer nuclear technology are really promising, and much less dangerous than we imagine. It may be the most efficient way to create energy and shouldn't be overlooked."
3	Positive	"Nuclear sources of radiation are not exclusively used for power generation only. We see it in nuclear medicine. We see it in some measurement instruments. Radiation is with us today."
4	Positive	"Cutting pollution and reducing millions of premature deaths annually through the burning of fossil fuels is a good enough reason for me to pursue a sustainable path towards alternative technologies."
5	Negative	"Definitely a NO. If anything happened, there will not be any place to run to. The whole country will be wiped out instantly and Singapore will become a vacant land."
6	Negative	"Should a nuclear plant disaster occur in Singapore, this small island will be turned into a vacant land, not fit for humans to live in, for a very long time."
7	Negative	"The repercussions of a nuclear fallout are widespread. They're not only detrimental to us but our neighbouring countries too. This is a catastrophe we can ill afford to gamble with."
8	Negative	"Just remember that we are a small country and if a meltdown ever happens, we will either all die instantly or die slowly, some may be lucky to become mutants."

Appendix D

Information Sheet and Consent Form

Study Information Sheet

A/P Shirley Ho Soo Yee
Wee Kim Wee School of Communication and Information
Nanyang Technological University
Email: tsyho@ntu.edu.sg
Tel: (+65) 6790-6044

Title of Study: Perceiving Online Public Opinion Towards Nuclear Energy.

Objective: This study seeks to learn more about attitudes toward nuclear energy in Singapore. It will involve 360 Singapore citizens and permanent residents who are current Facebook users.

Procedures: This survey experiment will last for approximately 15 minutes. First, you will be required to answer a survey questionnaire. Second, you will be exposed to a screenshot of a Facebook group page, and you will be required to closely observe all elements of the Facebook article posted by a member of the Facebook group. Finally, you will be required to answer a second questionnaire.

Right to Refuse or Withdraw: Your participation in this study is completely voluntary. You may withdraw from the study at any point without penalty. Your decision to participate, decline, or withdraw participation will have no effect on your status or relationship with Nanyang Technological University.

Risks and Discomforts: There are no anticipated risks involved in this study beyond that encountered in your daily life. All your responses and personal details provided will remain confidential.

Benefits: Through this study, you may gain a better understanding of public attitudes toward nuclear energy and learn how to more accurately gauge online public opinion.

Compensation: You will receive points, that can be accumulated in exchange for vouchers, as remuneration for your participation upon successful completion of this study.

Anonymous and Confidential Data Collection: The data collection process will remain confidential. This means that all the data collected from this study will be securely stored and only be accessible to research team members.

Confidentiality of records: The data will be stored on external storage devices such as flash drives and cloud storage (e.g., Google Drive, Dropbox). All the platforms and

devices will be password-protected and access will be limited to research team members only. A designated researcher will be coordinating and overseeing the data storage. In addition, all relevant records collected for this study will be stored in a secure location on-campus and all the data collected for this study will be archived for 10 years in NTU. Thereafter, all information gathered from this study will be destroyed. All paper records containing personal information will also be shredded to ensure participant confidentiality.

Personal Data:

By signing the Consent Form attached, you (*or your legally acceptable representative, if relevant*) are authorizing (i) collection, access to, use and storage of your “Personal Data”, and (ii) disclosure to, and use and storage by, authorised service providers and relevant third parties, whether located in Singapore or overseas, for the purposes of the study, and for any other related research studies conducted by researchers in NTU.

“**Personal Data**” means data about you which makes you identifiable: (i) from such data; or (ii) from that data and other information which an organisation has or likely to have access. This includes medical conditions, medications, investigations and treatment history.

Research arising in the future, based on this “Personal Data”, will be subject to review by the relevant institutional review board.

Data collected are the property of Nanyang Technological University. In the event of any publication regarding this study, your identity will remain confidential.

Who to contact with questions: If you have any queries about this study, please feel free to contact either:

Ms. Alisius Deon Leong
Masters by Research
Wee Kim Wee School of Communication &
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Email: alisiusd001@e.ntu.edu.sg
Tel: (+65) 6790-6565

Dr. Shirley Ho
Associate Professor
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Nanyang Technological University
Email: tsyho@ntu.edu.sg
Tel: (+65) 6790-6044

If you have any concerns about your rights as a participant, you may contact the Institutional Review Board (IRB) at NTU at (+65) 6592-2495; email: irb@ntu.edu.sg

Consent Form

I have read, discussed and understand the information and procedures in the study information sheet attached to this consent form. My questions concerning the study have been answered to my satisfaction, and I acknowledge that I am participating in this study of my own free will. I understand that I may refuse to participate or stop participating at any time.

Consent to participate in the research

☐ Yes I agree to participate in this research.

☐ No, I do not agree to participate in this research.

Appendix E

Questionnaire

FILTER QUESTION

1. Are you an existing Facebook user?

☐ Yes

☐ No

PRE-TEST QUESTIONNAIRE

1.1 FACEBOOK USAGE PATTERNS

1. Please indicate the average amount of time you spend on Facebook in a typical week (from Monday to Sunday)?

_____ Hours _____ Mins

2. How often do you engage in the following activities on Facebook?

	Never Always						
a) Post a status	☐	☐	☐	☐	☐	☐	☐
b) "Like" a post	☐	☐	☐	☐	☐	☐	☐
c) Comment on a post	☐	☐	☐	☐	☐	☐	☐
d) "Share" a post	☐	☐	☐	☐	☐	☐	☐
e) Post links/videos for others to read	☐	☐	☐	☐	☐	☐	☐
f) "Follow" a Facebook page	☐	☐	☐	☐	☐	☐	☐
g) "Subscribe" to a Facebook page	☐	☐	☐	☐	☐	☐	☐

1.2 ATTITUDE TOWARDS NUCLEAR ENERGY

On a scale of 1 (strongly disagree) to 6 (strong agree), to what extent do you agree with the statement below:

"I support the adoption of nuclear energy in Singapore."

Strongly disagree			Strongly agree		
○	○	○	○	○	○

1.3 DEMOGRAPHICS

1. What is your gender?

- ☐ Male
☐ Female

2. What is your age?

3. What is your nationality?

- ☐ Singaporean Citizen
☐ Permanent Resident
☐ Foreigner, please specify: _____

4. What is your ethnicity?

- ☐ Chinese
☐ Indian
☐ Malay
☐ Eurasian
☐ Others, please specify: _____

5. What is your highest educational level?

- ☐ No qualification
☐ GSCE "O" Levels
☐ GSCE "A" Levels/ International baccalaureate
☐ Diploma & Professional Qualification
☐ Bachelor's degree or equivalent
☐ Master's degree/ postgraduate
☐ Doctoral degree

6. What is your marital status?

- ☐ Single
☐ Married
☐ Others

7. Do you have children under the age of 12?

- ☐ Yes
☐ No

8. What is your monthly household income (SGD)?

- ☐ Up to \$2,499
☐ \$2,500-\$4,999

- ☐ \$5,000-\$7,499
- ☐ \$7,500-\$9,999
- ☐ \$10,000-\$12,499
- ☐ \$12,500-\$14,999
- ☐ \$15,000 and above
- ☐ Prefer not to disclose

9. What is your religion?

- ☐ Buddhism
- ☐ Christianity
- ☐ Catholicism
- ☐ Islam
- ☐ Taoism
- ☐ Hinduism
- ☐ Others, please specify: _____

POST-TEST QUESTIONNAIRE

1.1 WILLINGNESS TO SPEAK OUT

On a scale of 1 (very unlikely) to 7 (very likely), how likely are you to engage in the following activities with regard to nuclear energy on Facebook?

	Very unlikely Very likely						
a) Argue for my position.	☐	☐	☐	☐	☐	☐	☐
b) Provide a neutral comment on the post.	☐	☐	☐	☐	☐	☐	☐
c) Talk about the opinion of someone else	☐	☐	☐	☐	☐	☐	☐
d) Pretend to agree with the majority opinion.	☐	☐	☐	☐	☐	☐	☐
e) Click the “like” reaction emoji	☐	☐	☐	☐	☐	☐	☐
f) Click the “love” reaction emoji	☐	☐	☐	☐	☐	☐	☐
g) Click the “sad” reaction emoji	☐	☐	☐	☐	☐	☐	☐
h) Click the “angry” reaction emoji	☐	☐	☐	☐	☐	☐	☐

1.2 PERCEPTIONS OF THE OPINION CLIMATE

On a scale of 1 (strongly disagree) to 7 (strong agree), to what extent do you agree with the following statements?

	Strongly disagree Strongly agree						
a) People in this Facebook group are supportive of nuclear energy.	☐	☐	☐	☐	☐	☐	☐
b) My family is supportive of nuclear energy.	☐	☐	☐	☐	☐	☐	☐
c) My friends are supportive of nuclear energy.	☐	☐	☐	☐	☐	☐	☐
d) Singaporeans are supportive of nuclear energy.	☐	☐	☐	☐	☐	☐	☐
e) Singaporeans will be supportive of nuclear energy over the next 10 years.	☐	☐	☐	☐	☐	☐	☐

1.3 MANIPULATION CHECKS

Opinion cues

Which of the following did you view earlier?

- ☐ User-generated comments
- ☐ Reaction emojis (e.g., “like,” “love,” “angry,” “sad”)
- ☐ Both
- ☐ I did not notice them

Source credibility

Overall I find the Facebook page to be ...

a) Trustworthy	☐	☐	☐	☐	☐	☐	☐	Untrustworthy
b) Unbiased	☐	☐	☐	☐	☐	☐	☐	Biased
c) Reliable	☐	☐	☐	☐	☐	☐	☐	Unreliable

d) Expert	☐	☐	☐	☐	☐	☐	☐	Non-expert
e) Qualified	☐	☐	☐	☐	☐	☐	☐	Unqualified
f) Experienced	☐	☐	☐	☐	☐	☐	☐	Unexperienced

Table 1.⁵

Participants in each experimental cell

Condition	Number of participants
Group 1: Pro-nuclear energy participants who were allocated to a congruent opinion climate	85
Group 2: Anti-nuclear energy participants who were allocated to a congruent opinion climate	93
Group 3: Pro-nuclear energy participants who were allocated to an incongruent opinion climate	70
Group 4: Anti-nuclear energy participants who were allocated to an incongruent opinion climate	102

⁵ Participants were randomly assigned into either a congruent opinion climate or incongruent opinion climate condition based on their initial self-reported attitudes toward nuclear energy. During data analysis, participants were further sub-divided based on their initial attitudes (i.e., whether they were pro-nuclear energy or anti-nuclear energy).

Table 2.

Two-way ANOVA for opinion cues and opinion climate congruency on perceptions of the opinion climate.

	Type III Sum of Squares	df	Mean Square	F	<i>p</i>	partial η^2
Corrected Model	391.38 ^a	11	35.58	37.05	.00	.55
Intercept	4040.64	1	4040.64	4207.36	.00	.93
opinion cues	5.14	2	2.57	2.68	.07	.02
opinion climate	318.42	3	106.14	110.52	.00	.50
congruency						
Opinion cues x opinion climate	47.12	6	7.85	8.18	.00	.13
congruency with initial attitude on nuclear energy						
Error	324.61	338	.96			
Total	4831.64	350				
Corrected Total	715.98	349				

a. R Squared = .55 (Adjusted R Square = .53)

Table 3.

Two-way ANOVA for opinion climate congruency and source credibility on willingness to speak out

	Type III Sum of Squares	df	Mean Square	F	<i>p</i>	partial η^2
Corrected Model	15.45 ^a	3	5.15	5.15	.00	.04
Intercept	4006.23	1	4006.23	4005.49	.00	.92
Source credibility	11.08	1	11.08	11.08	.00	.03
Opinion climate congruency	.72	1	.72	.72	.40	.00
Source credibility x Opinion climate congruency	4.02	1	4.02	4.02	.05	.01
Error	346.07	346	1.00			
Total	4484.38	350				
Corrected Total	361.51	349				

a. R Squared = .04 (Adjusted R Square = .03)

Figure 1.

Main effect of opinion climate congruency on perceptions of the opinion climate

Note: Scale ranges on the y-axis is only partially displayed.

Figure 2.

Interaction effect of opinion cues and opinion climate congruency on perceptions of the opinion climate

Note: Scale ranges on the y-axis is only partially displayed.

Figure 3.

Main effect of source credibility on willingness to speak out

Note: Scale ranges on the y-axis is only partially displayed.

Figure 4.

Interaction effect of source credibility and opinion climate congruency on willingness to speak out

Note: Scale ranges on the y-axis is only partially displayed.

Figure 5.

Effect of opinion climate congruency on willingness to speak out, as mediated by perceptions of the opinion climate