

The Spiral of Silence and the Crescendo of Voices

Opinion Expression after Fukushima Nuclear Crisis

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Abstract

This paper examines the seminal spiral of silence hypothesis through a survey experiment conducted in Japan. While the existing studies either rely on hypothetical questions in surveys or experiments with selected samples, we tested the hypothesis with a real on-going issue in Japan regarding the future of nuclear power plants after the Fukushima crisis based on nationwide random samples. In our experiment, different stimuli of climates of opinion and survey modes were randomly assigned to respondents based on a computer assisted survey program. We hypothesized that respondents who are given an anti-nuclear climate of opinion are more likely to support the reduction of nuclear power plants and that this only holds in the CAPI (Computer Assisted Personal Interview) mode where their answer is known to interviewers and respondents are prone to project “socially desirable” answers. We expected that this also applies to respondents who are not given a climate of opinion and have to rely on their “quasi-statistical sense” in the midst of anti-nuclear atmosphere. Our results demonstrate the spiral of silence (and the crescendo of voicing a majority view) phenomenon for above groups of respondents and this was only confirmed in the CAPI mode while not in the CASI (Computer Assisted Self-administered Interview) mode where respondents complete the questionnaire in privacy by themselves.

Introduction

“The opinion of only part of the population seemed to be the opinion of all and everybody” (Tocqueville, 1856: 259), as phrased by Alexis Tocqueville in the middle of 19th century, public opinion formations have been studied by many social scientists in rigor. It is in fact this statement that Elisabeth Noelle-Neumann put to the test in her seminal work on “the spiral of silence” where she found a common “social-psychological mechanism” in articulating an opinion in public (Noelle-Neumann, 1974). Since then wealth of empirical research has been conducted; some studies corroborated with the main propositions (e.g. Eveland, McLeod, and Signorielli 1995; Glynn and McLeod 1984; Glynn, Hayes, and Shanahan 1997; Kim, Han, Shanahan, and Berdayes 2004; Neuwirth 2000; Willnat 1996; Willnat, Lee, and Detenber 2002), while others did not fully lend support to the theories (e.g. Huang 2005; Oshagan 1996; Petic and Pinter 2002; Scheufele and Eveland 2001). Although much research has been done in the past decades to test “the spiral of silence” theory, it is still not clear if and on what conditions this theory holds. This is reflected in the words of Bodor (2012) stating “it is a common sentiment among scholars that the spiral of silence is a theory that might make sense intuitively, yet, has weak empirical grounding.”

The absence of consensus, in our view, largely derives from three limitations in the literature that we review below, (1) a lack of reality in survey questions, (2) a lack of external

validity in the findings of experiments, and (3) exclusive attentions paid to *whether or not* to express in public rather than *what* to express in survey questions. In light of these limitations, we examine the hypotheses derived from “the spiral of silence” theory based on an ongoing issue of nuclear power plants after the Fukushima disaster in Japan through a survey experiment conducted with nationwide random samples. The experimental design was made possible by the CAI (Computer Assisted Interview) systems developed in our research team and survey modes between CASI (Computer Assisted Self-administered Interview) and CAPI (Computer Assisted Personal Interview) are randomly assigned to respondents to see if “socially desirable” answers lead to a spiral of silence in the CAPI group where interviewers intervene in the answering process, rather than in the CASI group.

The paper first reviews the theories of “the spiral of silence” and studies that have examined these hypotheses. While addressing a need for a survey experiment, we describe the design of our experimental survey and formulate hypotheses. We then present the results and discuss how the findings can add to our understanding about the theory of “the spiral of silence”.

1. Empirical studies of the spiral of silence theory and their limitations

Public opinion formation has been a central concern among students in communication as well as political science (Iyengar and Kinder, 1987; Zaller, 1992). Public opinion shifts are traced mostly

through opinion polls as aggregated numbers of individual answers (e.g. Page and Shapiro 1992). Yet, the connections between macro-level phenomenon and micro-level behaviours are not necessarily straightforward, as the spiral of silence theory insists (Noelle-Neumann 1974). The macro-level opinions are not only results of summing up the micro-level responses in surveys but could also be causes of the way people answer in surveys based on their perceptions of the opinion climate. Noelle-Neumann (1974) began with the example of electoral polls and forecasts in Germany and explained the electoral results by the spiral of silence process, in which the aggregated opinions affected expressed public sentiment.

When the spiral of silence mechanism works at the micro level, theoretically three conditions should be satisfied. First, people should be afraid of being isolated from the environment they belong to. Second, an issue requires some moral and ethical judgements so that a conflict of opinions could lead to social isolation. Third, the information on climate of opinion can be accessible among the public. Before being punished from social groups for “failing to toe the line” (Noelle-Neumann 1974: 43), people rely on what is coined as “quasi-statistical organ” (44). According to Noelle-Neumann, people have a sensitive skin by nature to gauge the “climate of opinion” in society and constantly judge if their opinion is shared by others. If one’s opinion is also voiced by the majority of people in society, they gain confidence and express their view more openly in public. On the contrary, if they judge that their view is not commonly held, the

minor view is muted and further silenced in spiral as they choose to conceal their view. The above three conditions thus form a foundation of Noelle-Neumann's theorisation of "spiral of silence" and her related arguments for dynamic processes of public opinion formations (Noelle-Neumann, 1974; 1977; 1991; 1993; Scheufele and Moy, 2000).

Empirically, the spiral of silence theory has been examined in a number of studies since its proposal, based on either one of two research designs. The first one utilizes a large-scale survey with a hypothetical question. Originally by Noelle-Neumann (1974), in the surveys, respondents were first asked about their opinions on a controversial issue (e.g. abortion law and capital punishment) as well as what the majority currently think about the topic and what the trend of opinions in the future they think would be. Respondents were then asked to *imagine* a conversation among passengers on a long train journey and questioned if they would like to share their opinion in such a public situation. A majority of empirical studies thereafter followed this approach to present a hypothetical situation and compare the "willingness to speak" when the own view is in the majority and in the minority¹.

Dissatisfied with these empirical studies, which maintain that the spiral of silence can be found through hypothetical scenarios imposed to respondents,² the second stream of researchers

¹ A meta-analysis of studies that presented a hypothetical situation in fact numbered as numerous as seventeen (Glynn, Hayes, and Shanahan 1997).

² To an extent, the pros and cons of the survey-based approach and the experimental approach reflect the discussions and critiques made against the well-known conformity experiments conducted before the spiral of silence proposition (Asch, 1955; Milgram, 1961). The survey-based approach taken by the original study (Noelle-Neumann, 1974) could be understood as an

has adopted an experimental approach in measuring the extent to which people actually refrain from expressing the own opinion given a certain stimulus. Hayes, Shanahan, and Glynn (2001) conducted an experiment based on university students and found that participants are more willing to discuss with others when they perceive a substantial support for their own opinion. A larger scale experiment using a split sample of university students conducted by Moreno-Riaño (2002) also reports that respondents given a perceived majority climate of opinion tend to shift their opinion towards the majority. Ho and McLeod (2008) equally observed a spiral of silence effect once students are given a task to discuss with others about their minor opinion. The findings from these experimental studies generally attest to the spiral of silence propositions.

These two streams of empirical tests, however, are faced with serious limitations. On one hand, the first, original approach with a large-scale survey, as the experimental studies criticized, the main dependent variables are measured by purely hypothetical questions, not an actual response to the controversial issue. It is not clear that how the answer in hypothetical situations reflects how people respond in reality, which is our main target of interest. On the other hand, the experimental studies have been likewise criticized for the lack of “external validity” (Scheufele and Moy 2000: 12). Given that most of the experimental studies is based on samples drawn from university students, implications of the obtained results are bound to be

alternative approach to the experimental approach.

limited. These tend to lack the sample representation and undermine external validity, which is in fact guaranteed in the first approach. This lack of external validity is a serious drawback as the theory of spiral of silence is concerned with how public opinions are formed in society.

More importantly, both the two stream of empirical strategies share another problem: little attention to *expressed* opinion in surveys. Much research focuses on a “willingness to express” in public and does not investigate an *actual opinion*, which constitutes public opinion. Given that the spiral of silence theory is concerned with the processes of public opinion formations, one should naturally look at “what to express” rather than “whether or not to express”.

With these limitations in the extant research in mind, we employ the third research method, a survey experiment, by adopting both survey and experimental approaches in one design. We conducted a survey experiment based on nationwide random samples to ensure external validity. We then pay attention to *expressed opinions*, rather than *outspokenness*, to investigate the relationship between the climate of opinion and their reactions. Therefore, in the survey experiment, rather than asking respondents to imagine a public situation, we ask an *actual* opinion of respondents on a real-life on-going issue in society³.

³ Bodor (2012) shares this view as stating “a spiral of silence may only be detected *if* and *when* it actually occurs.”

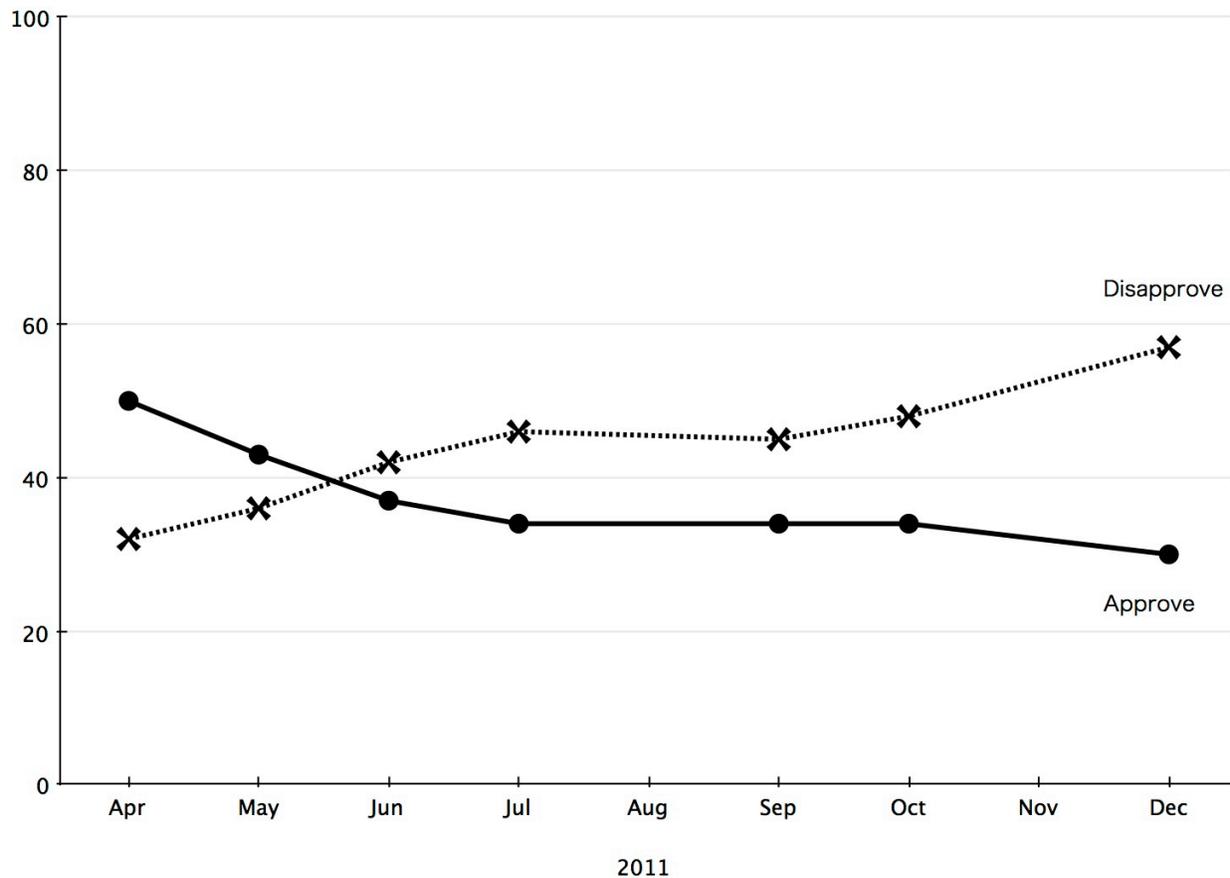
2. Fukushima nuclear crisis and the spiral of silence

As an actual issue in society to be examined, we focus on a much debated issue in Japan on whether nuclear power plants should be maintained or reduced in future. Since the earthquake hit in the East Japan on March 11, 2011, followed by massive tsunami and by the crisis in Fukushima Daiichi Nuclear Power Plant, pros and cons on nuclear energy have been extensively discussed in public. While some argue that nuclear power plant should be in operation for economic growth under the situations where no alternative methods are reliable and cost cheaper, others question the safety of nuclear power plants and insist that they should be immediately abandoned. Figure 1 shows the distribution of public opinion regarding the future of nuclear plants in Japan from April to December 2011⁴. The figure illustrates that mass opinion has shifted from maintaining the status quo to abandoning the plants in these months.

⁴ The figure is based on the *Asahi Shimbun* Newspaper's monthly polls. The question is as follows: "do you approve or disapprove of usage of nuclear power plant?"

Figure 1. Changing Mass Opinion on Usage of Nuclear Power Plants, *Asahi Shimbun*

Newspaper Telephone Surveys



The shift of mass opinion towards anti-nuclear plants after the nuclear power plant crisis

on March, shown in Figure 1, could be read as a spiral of silence in progress. Let us examine

here the three conditions to be met for a spiral of silence to occur. First, the literature suggests as

an assumption for a spiral of silence to be activated, the issue should possess a moral component,

and social pressures driven by social norms influence the ways in which opinions are expressed

in public. Our example of nuclear plants is considered to entail this aspect and the fact that

important earlier studies on a spiral of silence also examined the issue of nuclear plants signifies the relevance of this issue in the spiral of silence theory (Noelle-Neumann 1991; Taylor 1982). Second, the media reported the shifting “climate of opinion” and scenes of anti-nuclear demonstrations and protests. It is thus reasonable to expect that respondents have relied on “quasi-statistical sense” in survey settings for expressing what is perceived as a ‘right’ opinion.

The remaining condition is concerned with the fear of isolation. One might question if respondents would feel a pressure of being isolated in a survey setting as far as their answer is kept anonymous. However, respondents are not in fact completely free from the fear of isolation. It has been suggested in survey research that respondents are inclined to express “socially desirable” opinions when they are directly questioned by an interviewer in person (Tourangeau and Yan 2007; Kreuter, Presser, and Taurangeau 2008). So-called “social desirability bias”⁵ occurs when respondents conform to majority opinion and answer based on what they consider as a “social norm”. This is the same psychological mechanism at work in the spiral of silence theory when people change the ways in which they express their own opinion (Berinsky 2002; Glynn and Park 1997). Thus, one could reasonably expect a spiral of silence phenomenon to occur in a survey setting like telephone surveys where respondents are put under normative pressure to conform to a social norm in the presence of an interviewer.

⁵ Social desirability bias refers to “the tendency to present oneself in a favourable light.” (Grove, Fowler, Couper, Lepkowski, Singer, and Tourangeau 2009: 168).

In this study, we examine the occurrence of this spiral of silence phenomenon, adopting an survey experimental approach as detailed below by randomly assigning different climates of opinions and survey settings. Although the three conditions should be satisfied, observing the trend in public opinion on nuclear power plant over time only enables us to infer that a spiral of silence phenomenon was present. In the survey experiment, we control for the latter two conditions of a spiral of silence occurrence, a climate of opinions and a fear of isolation, to confirm public opinion formation.

3. Design and Hypotheses

Design of survey experiment

To ensure external validity, we conducted a nationwide random sample survey in 2011⁶, we asked respondents to express their opinion about the nuclear power plants in Japan through the following question: “*What do you think should be done with nuclear power plants in the country in future?*” While respondents eventually chose from four categories, (1) “Should construct more

⁶ The Waseda-CASI2011 data was collected through the CASI mode, in which interviewers brought a laptop computer to respondents and asked to input the answers by themselves. The population is nationwide Japanese citizens who are older than 20 years old, based on the two-step stratified random sampling from voter registration list (and basic resident register, *Jyumin Kihon Daicho*, for some local cities). The response rate is 41.18% (1483 complete interviews, 1463 refusals and break-offs, 555 non-contacts, and 100 other cases) in the AAPOR’s standard (RR1). The survey started on October 7, 2011 and ended on November 7, 2011. The survey was conducted as one of the projects in the Global COE project “Political Economy of Institutional Construction” (Graduate School of Economics, Waseda University) with the financial support from Ministry of Education, the Japan Government. The survey was conducted by Aiji Tanaka (Principal Investigator), Yoshitaka Nishizawa, Airo Hino, Takeshi Iida, and Ryosuke Imai with support from Masahisa Endo, Ryo Hosogai, Kiichiro Arai, Norihiro Mimura, and Arata Yamazaki. Needless to say, all errors remained in this paper are ours.

nuclear power plants”, (2) “Should maintain all the nuclear power plants”, (3) “Abandon some nuclear power plants”, (4) “Abolish nuclear power plants totally” (or “Do not know” or “Do not want to answer”), they were given a set of different treatments as follows.

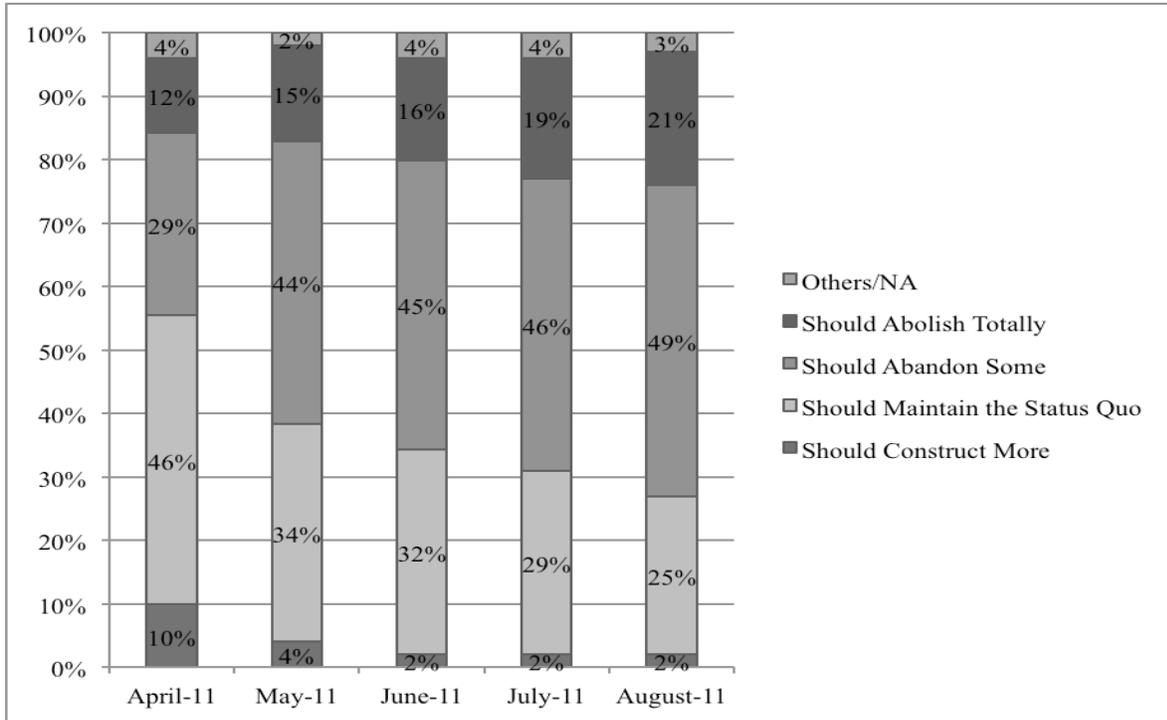
First, following the previous studies that discussed how the climate of opinion perceived affects the opinion formation (e.g. Daschmann 2000), we gave a different “climate of opinion” to respondents. In concrete, we randomly assigned respondents one of three groups. While one group received no information of “climate of opinion,” the other two groups among three received following statements and the below information of distribution of opinion in society before being asked their opinion about the nuclear plants: *“In a recent public opinion survey conducted by a newspaper, the following question was asked: ‘What should be done with nuclear power plants in the country in future?’ The responses to this question showed the following distribution of opinions.”*

The distribution of opinions shown to respondents derives from the actual opinion survey conducted by the *Yomiuri Shimbun* Newspaper which has the largest circulation in Japan. Figure 2 shows the distribution of public opinion regarding the nuclear plants in Japan from April to August 2011.⁷ The figure illustrates that mass opinion has shifted from maintaining the status quo to abandoning the plants in four months.

⁷ The actual question follows *“Japan has relied nearly 30% of energy on nuclear plants. What do you think should be done with nuclear plants in the country in future?”*

Figure 2. Changing Mass Opinions on Nuclear Power Plants in Future, *Yomiuri Shimbun*

Newspaper Telephone Surveys



To one of the two treatment groups, we showed the distribution of public opinion in April, while we showed the distribution in August to the other treatment group.⁸ We therefore randomly assigned respondents (1) a group in which respondents were shown the distribution in April (when “should maintain the status quo” and “should construct more” were the majority) and asked to express their own opinion (we call this group “Pro” group), (2) a group in which respondents were shown the distribution in August (when “should abandon some” and “should

⁸ To be precise, the follow-up question is modified accordingly: “How would you answer to the same question: ‘What should be done with nuclear plants in the country in future?’”

abolish totally” were the majority) and asked to express their own opinion (“Anti” group),⁹ and (3) a group in which respondents were asked to express their opinion about the future of nuclear power plants without being given any information about the “climate of opinion” (“No Info” group). The purpose of giving these stimuli is to see if respondents are influenced by the “climate of opinion” and express their opinion in line with the trend in society.

Second, we randomly assigned respondents to two different survey modes. Social desirability bias is known to be present in the surveys with interventions of an interviewer. These include the survey modes of Paper-and-Pencil Interview (PAPI), telephone interview, and CAPI (Computer Assisted Personal Interview). On the contrary, in the surveys where respondents record their answers by themselves, social desirability bias would not be present. The survey modes such as Self-Administered Paper and Pencil Questionnaire (PAPI-SAQ), mail survey, web survey, and CASI (Computer Assisted Self-administered Interview) apply to these cases. Ample studies have tested the effect of modes on the ways in which social desirability bias develops (Chang and Krosnick 2009; 2010; Heerwegh 2009; Holbrook, Green, and Krosnick 2003; Kreuter, Presser, and Tourangeau 2008; Richman, Kiesler, Weisband, and Dragow 1999; Tourangeau and Smith 1996; Wright, Aquilino, and Supple 1998; cf. Krysan 1998).

We bring this knowledge into our experimental design and assign one group the mode of

⁹ Strictly speaking, surveys with the same experimental design should have been conducted for both periods of April and August 2011. However, given a limitation in such data collection, we conducted an experimental survey later on and provided the information of the climate of opinion in April and August as the second best design.

CAPI and the other group the mode of CASI. In the CAPI survey, privacy is not secure since an interviewer reads aloud the question and asks a respondent to choose one of options on the computer screen under the interviewer's supervision¹⁰. On the other hand, during the CASI survey, respondents complete a survey by themselves through a computer automated questionnaire system. An interviewer is instructed not to look at the computer screen and to keep a reasonable distance for ensuring an anonymous and eye-free environment for respondents.

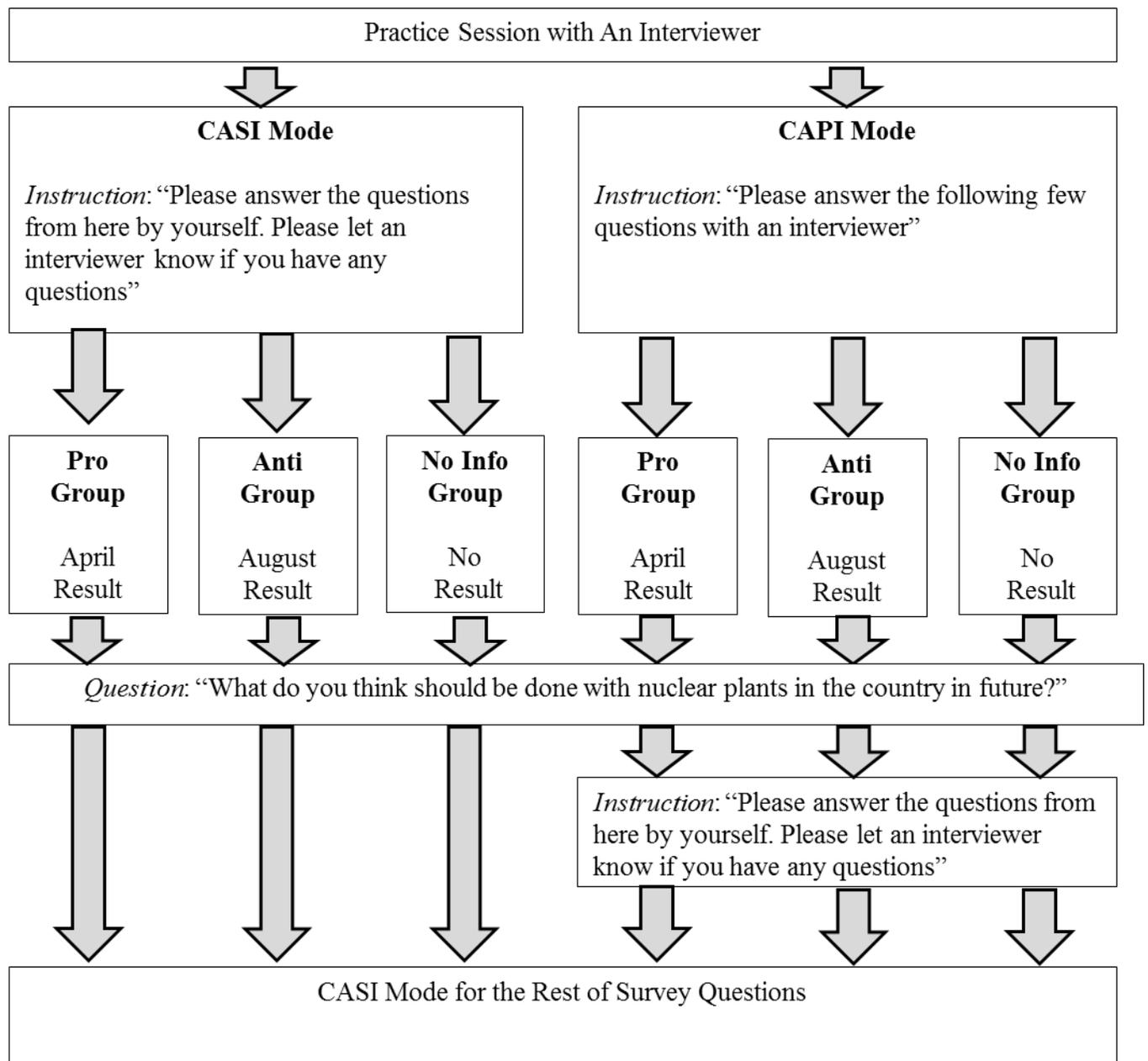
Procedures of our experimental survey are as follows. All the respondents were given some practice questions to get used to answering on computer screens (see Figure 3). This practice session is guided through by an interviewer who explains to and communicates with respondents. We assigned one group of respondents to start completing the questionnaire through the CASI mode without interventions of an interviewer right after the practice session ends. We assigned the other group of respondents to start completing the questionnaire through the CAPI mode in which interviewers ask questions and see what respondents answer.¹¹ The purpose here is to make respondents answer to the question about nuclear power plants in the presence of an interviewer through the CAPI mode and to see if they feel a pressure to express a “socially desirable” opinion. This sort of social desirability effect should not be present when privacy of

¹⁰ In this sense, our CAPI survey is a self-record survey under the interviewer's supervision, which is not necessarily similar to the regular CAPI survey, in which the interviewer brings a computer, asks questions, and records the answers.

¹¹ After the question about nuclear plants, interviewers were asked to leave the computer to respondents and complete the rest of questionnaires by themselves through the CASI mode.

opinion is kept in the absence of interviewers' interventions in the CASI mode.

Figure 3. The Procedure of Survey Experiment



This design to switch modes in the middle of surveys takes into account the caveats underlined in previous studies. In the studies that compare the effects of different survey modes in the field on response patterns, it is often difficult to judge if differences in response patterns result from the difference of survey modes or from the difference of respondents' compositions.¹² Studying the effects of survey modes on respondents' tendency to express a "socially desirable" view, previous studies pointed out the need to minimize the "nonresponse bias" in comparing different survey modes (Kreuter, Presser, and Taurangeau, 2008; Krysan 1998; Wright, Aquilino, and Supple 1998). Since it has been difficult to remove "nonresponse bias" in surveys in the field completely, one could not easily disentangle the "social desirability bias" from "nonresponse bias" in representative sample. In our experiment respondents are solicited in the same way to participate in the survey. Even interviewers do not know which mode comes beforehand due to the program setting in which the mode is randomly assigned after the survey starts. The composition of respondents is therefore expected to be identical for both assigned groups of CASI and CAPI.¹³

To reiterate, we gave two sorts of treatments to respondents, the "climate of opinion" and "survey mode". Respondents are thus randomly assigned to six groups resulting from this 3

¹² Respondents could refuse to participate in surveys for different reasons for each survey mode. For example, those who are not familiar with computers are more likely to refuse a computer-assisted survey like the CASI.

¹³ In fact, socio-demographic variables such as gender, age, and educational backgrounds did not differ statistically between the CASI group and CAPI group.

by 2 matrix: “CASI-Pro”, “CASI-Anti”, “CASI-No Info”, “CAPI-Pro”, “CAPI-Anti”, “CAPI-No Info”.¹⁴

Hypotheses

We can expect if a spiral of silence occurs for each of six experimental groups as shown in Table 1. The information presented to each group forms the “climate of opinion” condition for each group. While the public opinion result of *Yomiuri Shimbun* Newspaper in April forms pro-nuclear-power-plant climate for the “CASI-Pro” and “CAPI-Pro” group, the August one shapes the anti-nuclear-power-plant atmosphere for the “CASI-Anti” and “CAPI-Anti” group (see also Figure 2). Since no information about the distribution of mass opinions is presented for the “CASI-No Info” and “CAPI-No Info” groups, the respondents without any explicit information must form their opinion in accordance to their own “quasi-statistical sense”. As the survey took place for one month from October 7 to November 7, respondents have most likely perceived the climate of opinion shifting towards anti-nuclear energy, as Figure 1 shows. The support for the use of nuclear power plants dropped from 50% in April to 30% in December 2011, whereas the opposed view rose from 32% to 57% in the same period.

¹⁴ We further divided these six groups to twelve groups by including the statement “*Japan has relied nearly 30% of energy on nuclear power plants*” in half of respondents. Since our web based pre-test survey conducted in August 2011 confirmed that there is no significant difference among the groups with and without this statement, we kept the number of assigned groups to six instead of twelve in our analyses.

Table 1. Expected Results of the Survey Experiment

	Randomized Treatments			Expected Effect
	The presented information of opinion distribution	The Interviewer Intervention	The climate of opinion for “Should maintain the SQ”	Spiral of Silence Phenomenon among those who prefer “the SQ”
CASI-Pro	April Poll Result	No	Majority	Absent
CASI-Anti	August Poll Result	No	Minority	Absent
CASI-No Info	No information	No	Possibly Minority	Absent
CAPI-Pro	April Poll Result	Yes	Majority	Absent
CAPI-Anti	August Poll Result	Yes	Minority	Present
CAPI- No Info	No information	Yes	Possibly Minority	Present

In these situations, we can reasonably expect, as the spiral of silence theory suggests, that those respondents who know or detect that their opinion of “should maintain the status quo” being in “minority” or in “possibly minority” would feel a fear of isolation and refrain from expressing an honest opinion. The question is whether such fear of isolation would be evoked in a survey field when interviewers’ interventions are present or absent. This is related to the following random assignment of survey mode.

The random assignment of a survey mode (CASI or CAPI) allows us to investigate the conditional effect of survey modes on a spiral of silence phenomenon. A spiral of silence phenomenon would be observed in the CAPI survey mode since, under the interviewer’s

monitoring, some respondents hesitate to express a “socially undesirable” opinion. On the contrary, in the CASI survey mode, when no interviewers can know the answers, respondents would dare to express the socially undesirable opinion, discouraging a spiral of silence occurrence.

To recapitulate, our main hypotheses are formulated as follows.

Hypothesis 1: In comparison with the group “Pro”, the groups of “Anti” and “No Info” show a significantly lower support for maintaining nuclear power plants.

Hypothesis 2: This relationship holds for the comparisons among the CAPI experimental groups, not among the CASI experimental groups.

The dependent variable, the opinions on national nuclear power plant policy, was measured through the question with five nominal options, as discussed: (1) Should Construct More Nuclear Power Plants, (2) Should Maintain All the Nuclear Power Plants, (3) Abandon Some Nuclear Power Plants, (4) Abolish Nuclear Power Plants Totally, and (5) DK/NA.

Comparing the distribution of opinions in the future of nuclear power plant, the hypotheses are statistically tested. The statistical tests between the paired two (“Pro”-“Anti” and “Pro”-“No Info”) rely on multinomial logit model since the dependent variable is measured with nominal

options (See Appendix for the results). In the model, the dummy variables for each experimental condition (“CASI-Pro”, “CASI-Anti”, “CASI-No Info”, “CAPI-Pro”, “CAPI-Anti”, “CAPI-No Info”) are the independent variables. After estimating the model, we calculate the predicted probabilities in each opinion on nuclear power plants for each experimental group.

4. Empirical Results

The respondents in our survey were randomly assigned by the computer program after the survey session started. Table 2 shows that the number of respondents in each group. The socio-economic backgrounds of respondents are very similar among the groups and have no statistically significant differences.

Table 2. Number of Respondents in Each Group

	Number of Respondents
CASI-Pro	197
CASI-Anti	231
CASI-No Info	208
CAPI-Pro	193
CAPI-Anti	206
CAPI- No Info	213

In the CASI survey, the climate of opinion did not matter with opinion expressions (the upper part in Table 3). There is no statistical difference in the popular opinion “Should Abandon Some Plants” among the three groups: 40.61% in the “CASI-Pro” group, 42.42% in the “CASI-Anti” group, and 42.79% in the “CASI-No Info” group. Similarly, the opinion “Should Maintain the Status Quo,” the minor position in society, is somewhat equally distributed among three groups: 26.90% in the “CASI-Pro” group, 29.00% in the “CASI-Anti” group, and 20.19% in the “CASI-No Info” group (no statistical difference). No effect of information stimuli on these two key opinions supports our theory that in the privacy setting, people express their honest opinion regardless of social pressures or a climate of opinions.

Table 3. The Nuclear Power Plant Opinions

	CASI			Difference	
	Pro	Anti	No Info	Pro - Anti	Pro- No Info
Construct More	2.54	1.73	3.37		
Maintain the SQ	26.90	29.00	20.19		
Abandon Some	40.61	42.42	42.79		
Abolish Totally	18.78	19.91	16.35		
DK/NA	11.17	6.93	17.31		†
(Number of Obs)	197	231	208		
	CAPI			Difference	
	Pro	Anti	No Info	Pro - Anti	Pro- No Info
Construct More	2.07	1.94	3.29		
Maintain the SQ	34.72	26.70	18.78	†	**
Abandon Some	38.86	47.57	47.89	†	†
Abolish Totally	15.03	10.19	12.21		
DK/NA	9.33	13.59	17.84		*
(Number of Obs)	193	206	213		

† p < .10 * p < .05 ** p < .01

On the contrary, in the CAPI survey, the climate of opinions exerts influence over how people express their own opinion (the lower part in Table 3). In the “CAPI-Anti” group and the “CAPI-No Info” group, the opinion “Should Maintain the Status Quo” was discouraged compared to the “CAPI-Pro” group. While so answered 34.72% among the “CAPI-Pro” group,

the 26.70% among the “CAPI-Anti” group and 18.78% among the “CAPI-No Info” group expressed the unpopular opinion in front of the interviewer (significant at a 10% level for the “CAPI-Pro” and “CAPI-Anti” comparison and at a 5% level for the “CAPI-Pro” and “CAPI-No Info” comparison). As the spiral of silence theory assumes, the climate of opinion plays a role not only in diminishing the less favoured opinions but also in amplifying the favourite opinion in society. The result is much clearer in the majority opinion side. The “CAPI-Anti” (47.57%) and “CAPI-No Info” groups (47.89%) are more likely to express socially favoured opinion “Should Abandon Some Plants,” compared with the “CAPI-Pro” group (38.86%). The difference is statistically significant at a 10% level both in the “CAPI-Pro” and “CAPI-Anti” comparison and the “CAPI-Pro” and “CAPI-No Info” comparison.

From the above results, the empirical findings support our hypotheses. The CASI results show no relationship between information on public opinion and the respondents’ opinion expression. On the other hand, in the CAPI survey, we confirmed the influence of the climate of opinion on people’s willingness to express their opinion. The result suggests that public opinion on nuclear power plants is shifting towards anti-nuclear power plant, in part with a spiral of silence process caused by socially desirable bias under respondent-interviewer interactions in public opinion polls.

Conclusion

Reviewing the existing literature on the spiral of silence, this paper maintained that there is a need for examining this oft-researched hypothesis through an experimental survey with random samples in society. As the spiral of silence theory is concerned with shifting trend of mass opinion in society, it seems pertinent to observe the *actual* opinions properly sampled from society. Previous studies relied on either experiments drawn from non-random samples of selected students or national surveys without a rigorous experimental design. This paper took a dialectical turn to take the best of both approaches. While keeping the experimental mind to uncover a causal mechanism embedded in a spiral of silence process, we also aimed at representativeness in our samples to better reflect the nature of the original hypothesis. The CAI systems developed in our research team served this purpose well for controlling a multiple set of treatments.

We tested the spiral of silence hypothesis through the on-going issue in Japan about the future of nuclear power plants. The choice of a current issue stems from our reflection that the past studies have relied heavily on hypothetical scenarios and failed to tap a reality of a spiral of silence phenomenon. Monthly opinion polls conducted by national newspapers depict a gradual shift of mass opinions towards the anti-nuclear direction. In these natural experimental settings, we designed our survey to randomly assign different treatments to respondents selected from

random samples. In concrete, we gave two sets of stimuli to respondents that are composed of three climates of opinions (a pro-nuclear plant climate, an anti-nuclear plant climate, and without giving any climate of opinion thereby allowing the “quasi-statistical sense” of respondents) and two survey modes (the CASI mode in which respondents answer by themselves in privacy and the CAPI mode in which an interviewer intervenes in the answering processes and respondents’ answers are known).

The findings from this experiment were straightforward. We hypothesized that a spiral of silence occurs when respondents are given a climate of opinion that is against their own view and are asked to express their opinion in the presence of an interviewer. The analyses demonstrated that there were significant differences in expressed opinions between the group with a pro-nuclear climate and the group with an anti-nuclear climate or without any climate (thus based on respondents’ “quasi-statistical sense” to gauge an anti-nuclear mainstreaming in society at the time of the experimental survey). The importance here is that this spiral of silence phenomenon was only found *in the CAPI mode* when the answers of respondents were shared by an interviewer, while not in the CASI mode when the answers are virtually kept in secret. In other words, those holding the view of maintaining the status quo of nuclear power plants in the country or a pro-nuclear opinion refrained from expressing their view in the presence of an interviewer when they were given an anti-nuclear climate of opinion or they sensed such trends

in public opinion.

While confirming the spiral of silence hypothesis, our analyses also demonstrated that a majority view is further voiced in a survey setting once a climate of opinion is given or can be sensed. The spiral of silence research has mainly targeted at the process in which those who hold a minor view refrain from speaking in public. In this sense, the research to date has focused only on a declining process of minority opinions, which is one side of public opinion formation. Yet, the other side of public opinion formation, a rising process of majority opinions, has remained largely untested. Our study was an attempt to illuminate the neglected side of the public opinion formation, a crescendo of voices, a process in which a mainstreaming occurs in society. This process was confirmed in our analyses as people express a majority view when it is considered “socially desirable”. The spiral of silence hypothesis could thus be revisited from this perspective and we hope that future research would be pursued in a positive and rising spiral.

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Appendix A. Results of Multinomial Logit Analysis, Total Sample

(Sample Total)

	Construct More	Abandon Some	Abolish Totally	DK/NA	
“CASI-Pro”	-0.569 (0.621)	-0.339 (0.258)	-0.148 (0.315)	-0.725 (0.340)	*
“CASI-Anti”	-1.027 (0.657)	-0.371 (0.245)	-0.165 (0.300)	-1.278 (0.359)	***
“CAPI-No Info”	0.049 (0.578)	0.185 (0.264)	-0.219 (0.342)	0.103 (0.321)	
“CAPI-Pro”	-0.506 (0.905)	-0.484 (0.360)	-0.259 (0.460)	-0.538 (0.488)	
“CAPI-Anti”	0.149 (0.931)	0.012 (0.351)	-0.367 (0.468)	0.654 (0.484)	
(Constant)	-1.792 (0.408)	*** 0.751 (0.187)	*** -0.211 (0.231)	-0.154 (0.227)	
Number of obs			1248		
LR chi2 (20)			45.51		
Prob > chi2			0.001		
Pseudo R2			0.014		

Reference Category for Dependent Variable: Maintain the Status Quo

Reference Category for Independent Variable: “CASI-No Info” Dummy

* $p < .05$ *** $p < .001$