

Nudge for Reflection: More than Just a Channel to Political Knowledge

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Reflection, a process that organizes information into a structure that incorporates both own and others' perspectives, was previously believed to function mainly as an antecedent of political knowledge. In this paper, we first design a simple interface nudge to encourage users to reflect on their views on political issues. Second, we use an experimental study to show that reflection works in a way more than leading to political knowledge. Results from a between-subjects online experiment ($N = 168$) covering one crucial public issue in Singapore (i.e., fertility) showed that (a) reflection interacts with information access to influence perceived issue knowledge; (b) reflection enhances perceived attitude certainty, including perceived attitude clarity and perceived attitude correctness; (c) reflection promotes willingness to express opinions in private settings.

CCS CONCEPTS • **Human-centered computing~Collaborative and social computing~Empirical studies in collaborative and social computing** • Human-centered computing~Human computer interaction (HCI)~Interaction paradigms~Web-based interaction • *Human-centered computing~Collaborative and social computing~Collaborative and social computing systems and tools*

Additional Keywords and Phrases: Citizens, civic engagement, civic tech, nudges, deliberation, online discussions, reflection

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1 INTRODUCTION

Online public discussions are often found to be chaotic, and sometimes irrational and abusive [52]. Scholars believed that in order to counter these problems, reflection has to be an important component of our online discourses [3][15]. They argued that one essence of public deliberation is about the formation of well-informed, rational and reflective opinion for each individual. Driven by this normative expectation, our research piece provided both a theoretical and an empirical examination of reflection, through designing and implementing a

simple interface nudge. Theoretically, we adopted a cognitive approach to reflection as a process that transforms information into a structure [22][27]. Moreover, we specified this structuration process as both producing one's own perspective and taking other's perspectives to think through the information [15][23]. Design-wise, we used a set of interactive power point slides to provide information on a public policy issue and built in a simple interface nudge by asking participants to answer several questions that required participants to clarify their own opinions, urged them to put their feet in opponents' as well as policy-makers' shoes to think about the issues, and asked them what they think the reasons behind other people's positions are. Analytically, this study did not treat reflection as a simple yes or no division but separated reflection into three different levels based on its intensity, and demonstrated the non-linear results brought from different levels of reflection.

Our empirical examination first focused on reflection's main effects and its interaction effects with information access on political knowledge, because political knowledge is a key civic virtue and a critical component of effective citizenship [7]. Active involvement in public discourse is another crucial component of citizenship. Political expression has been found to mediate media use and political participation [14] and several scholars even included everyday talk as an important part of deliberative democracy [20][55]. A deliberative talk first of all requires expression of opinion, even under the risk of encountering dissents [43][49]. Next, rational exchange of quality opinions is expected for a deliberative talk [3]. These claims suggest two essential criteria for examining engagement in deliberation, i.e. attitude quality and willingness to express opinions [43][49]. Our study showed that reflection enhanced perceived attitude certainty and promoted willingness to express opinions in private, while information access exerted no such impacts. We discuss, at the end of the paper, how these results illustrated both the distinctive effects of reflection and a nudge design to encourage reflection in online public discussions.

The contribution of this work is three-folded:

- We proposed an improved conceptualization of reflection, in the context of online public discussions;
- We designed and implemented a simple interface nudge to provoke user reflection during reading a set of informational slides
- We experimentally tested the effects of different levels of reflection, and their interactions with information access.

2 BACKGROUND AND RELATED WORK

Nudging has been extensively studied in both HCI and other fields such as public administration and communication. We first start with a brief summary of nudging in HCI and the different contexts in which nudging has been used, followed by a discussion on how a simple interface nudge of question asking can help improve reflection.

2.1 Recent Work on Nudging for Reflection

Among the most recent work on nudging, Caraban et al. [4] presented a review of 71 HCI works in nudging, which allowed them to include 23 distinct mechanisms of nudging that they grouped into 6 categories. Nudging has been used as a mechanism to encourage users to be more reflective, such as reminding users of the consequences of their choices, e.g Harbach et al. [17] changed the permission dialogue of Google Play to illustrate potential impact on privacy depending on user's choice. Nudging can also be used to show other

people's viewpoint: Park et al. [33] designed NewsCube, an application that collects different points of views for an event and offers an unbiased clustered overview to the users, in order to reduce the confirmation bias. Menon et al. [28] took advantages of interface nudges (e.g., word length prompts) to mitigate the negative effects of cognitive overload and were found to have different levels of success in making online discourse more deliberative.

In our context, the goal is to improve the overall quality of an individual's opinion, when users are asked to think about a public issue [34]. For this specific purpose, we hope that simple interface nudges potentially improve political knowledge, attitude certainty, and willingness to express opinions.

2.2 Reflection

Reflection in this paper starts from a definition from existing studies, namely, "a process through which information is transformed into a structure that provides utility for the individual" [22](p. 76) [27] (p. 751). This definition is notably a cognitive one, referred to by some scholars as elaborative processing [9][10]. Previous studies using this cognitive definition showed that reflection can lead to accumulation of political knowledge [9][10]. This relationship was further clarified as that reflection functioned as a channel that mediated the relationship between news consumption on the one hand, and political knowledge and political participation on the other hand [6][27][46]. While most prior studies focused on knowledge as an outcome of reflection, an experiment embedded online survey [19] found that not only that individuals with stronger reflection propensity reported a greater perceived effect of the election debate clip on their candidate preference compared to low-reflection individuals, but also that reflection interacted with viewing a postdebate news analysis and knowledge to exert such influence.

Deliberation theorists' normative arguments suggested that reflection might have more influence than just enhancing political knowledge, channeling the influence of news consumption to political engagement, and altering perceptions of media influence. They recognized that reflection helps to form and change attitude attributes, a process critical to deliberative discourses. Bohman [3] (pp. 58-60) used the conception of "reflection equilibrium" by Rawls [41] to argue that reflection urges individuals to make explicit to themselves those previously latent understandings and reasons. These reasons prompted by reflection might become less convincing, because "formulating such reasons with sufficient detail is often enough to reveal the arbitrary and conventional character of the justification" and "requires answering the specific objections of the dissenter" [3] (p. 60). Price [38] also agreed that opinion expression, even at an intrapersonal level, could help opinion formation.

Inspired by these theoretical discussions, we believe that reflection could function more than just a channel leading to knowledge. It is therefore imperative to carefully craft the concept of reflection and thoroughly examine the effects of reflection. We thus synthesized theoretical ideas, sometimes seemingly in contradiction, from previous works. For instance, while Landmore and Mercier's [23] argumentative theory of reasoning argues against Goodin's [15] idea of "deliberation within" due to its private nature, both works see that deliberation should be about participants engaging with not only their own positions but also other people's (such as their opponents' and policy makers') positions. Our alternative definition takes the cognitive approach to defining reflection a step further: Reflection is more than just stating one's own opinions but forces participants to imagine themselves "in the place of others" [15] (p.209) and thus, provides a better chance for participants to re-structure their information pool through taking others' perspectives. Psychology studies called such re-

structuring “perspective-taking” [2][12]. These studies show that simply asking participants to write a narrative of an imagined other has many beneficial consequences: Perspective-taking induced empathy, evoked altruistic motivation, changed attribution, led to a merging of the self and the other, and decreased stereotypic biases. Following this rich tradition of perspective-taking studies, we further specify that reflection asks people to think about the opinions of an imagined other because deliberation is essentially about weighing of opinions [13].

Several empirical studies (e.g., [16]) already supported that articulation of opinions and reasons led people to recognize elements in mind, and composite opinions in their working memory, which could change attitude attributes such as attitude accessibility. It also helps to clarify people’s opinions and reasons, leading to rethinking of one’s own view [36]. Fournier and colleagues [11] found that vote intentions measured toward the end of the questionnaire, compared to the beginning of the questionnaire, showed lower non-response and were more in line with individuals’ underlying predispositions, which the authors argued was a result of simply answering questions in a long and evenhanded questionnaire and an indicator of capacity to articulate overall judgements and the quality of the judgements. Nekmat [29] found that asking participants to write personal messages significantly influenced the amount of cognitive efforts and information learnt. Moreover, answering questions that asked people to state reasons behind other people’s positions was shown to be an effective way to gauge one’s argument repertoire, which is treated as an indicator of the deliberativeness of one’s opinions [39]. Weinmann [48] developed a measure for “deliberation within”, which asked participants the extent to which they simulated others’ opinions and synthesized their ideas. She found that “deliberation within” positively related to political interest, internal efficacy, issue interest, issue comprehension, need for cognition, need for evaluation, and systemic processing. All these empirical studies point to the same conclusion: Reflection, defined as structuring information into one’s own and others’ opinions, has the potential to influence the quality of online discourse.

2.3 Political Knowledge

Political knowledge is a crucial component of citizenship. Delli Carpini [7] found that a higher level of political knowledge was associated with greater political participation, because knowledge helped citizens to understand the relevance of politics and the opportunities to engage in politics. Meanwhile, by developing links between their own opinions and concrete political issues, political knowledge also contributed to stable, consistent and meaningful attitudes. Research on political knowledge usually measured actual knowledge as recognition or recall of factual information (e.g., [9][46]). However, actual or factual political knowledge does not equate to perceived political knowledge. Postman [37] argued that exposure to superficial and entertainment-oriented content forged an illusion of perceived knowledge, which actually was detrimental for gaining actual knowledge. Empirical studies also supported the existence of discrepancy between actual and perceived political knowledge. For example, Hollander [18] found that talk show programs contributed to the feeling of being informed, while for those less educated, such exposure was not associated with actual knowledge. One explanation of why defaults are chosen is based on the ‘availability heuristic’. Here people decide on an estimate for the frequency of an event, or the likelihood of it occurring, based on the ease with which instances or associations regarding said events are recalled in the mind. Often, default options are implicit reflections of some external reality; wherein the default option is appropriate for a wide array of decision-makers. An example of this is “Save More Tomorrow” from Thaler and Sunstein [47], where they set default options related to health care plans, with the aim of helping citizens make safer choices regarding their health care. Another somewhat

extreme example of this is from Redelmeier and Shafir [42], who found that adding a new option increased the probability of choosing a previously available alternative, suggesting that default anchors can work across successive choice scenarios.

Few studies contrasted the effects of perceived vs. actual knowledge. An exceptional study from Park et al. [32] conducted experiments and found that people with low perceived knowledge were better at detecting similarities among items of information, and tended to value new information more than those with high perceived knowledge. Besides, once encountering new information, participants with low perceived knowledge revealed a global comprehension ability: They tended to resolve the conflict between new and old information, while those high in perceived knowledge just devalued the new contrasting information. These results suggest that unlike actual political knowledge, the lack of perceived knowledge might even play a benign role in democracy. Citizens might scrutinize information more carefully, and be more open-minded to adjust their positions, if they perceive that they have little knowledge.

We argue that reflection could influence perceived knowledge, especially through an interaction with information access. Park et al. [32] asked participants questions with different levels of difficulties. This treatment successfully changed levels of perceived knowledge, with more difficult questions leading to lower perceived knowledge. If we treat reflection as an intrapersonal format of political expression task, those who can reflect more thoroughly and extensively might regard reflection as an easy task, while those who cannot might experience sense of difficulties, which dampens their perceived political knowledge. In other words, reflection exposes ignorance for those who are unable to reflect at all and reduces their perceived political knowledge. We further argue that this is especially true when people are given no information access, because lack of information makes the task even more difficult. As reflection is a process of building a structure of information, which first retrieves information and then synthesizes these information, information access lowers the difficulty of the first step. However, we are not sure whether this difficulty reduction effect of information access has its own threshold or follows a simple linear direction (e.g., the more information, the lower perceived difficulty, and thus the higher perceived knowledge). Hence, we propose a hypothesis on the interaction effect between information access and reflection on perceived political knowledge.

H1: Reflection interacts with information access to influence perceived issue knowledge.

2.4 Attitude Certainty

Attitude certainty denotes “the sense of conviction with which one holds one’s attitude” [35]. There are two dimensions within attitude certainty: Attitude clarity, referring to the feelings that one knows one’s true attitude; and attitude correctness, the confidence that one feels one’s attitude is correct. Normatively speaking, attitudes with diverse qualities should not be treated equally and high quality attitudes should be weighed more than low quality attitudes [38]. Attitude certainty indicates one dimension of attitude quality. Those strong and certain attitudes are deemed as more qualified in public opinion research [40]. Attitude certainty also brings actual civic benefits according to empirical studies. It encourages information sharing behavior [5] and opinion expression, even when people are minorities in a group and face a spiral of silence [26].

Smith and colleagues [44] identified two sources of attitude certainty, i.e. informational source which refers to the amount of knowledge one holds, and structural source indicating the consistency of attitude-related information. They found that the amount and structural consistency of information both enhanced attitude

certainty. In particular, messages that were pre-tested to be evaluatively consistent (i.e., all positive or all negative) were found to decrease perceived ambivalence, which eventually led to attitude certainty. As we already argued in the previous section, reflection is a structuration process that incorporates other people's viewpoints into one's consideration and thus, reflection may help to organize diverse information into a consistent structure, which could enhance attitude certainty. In addition, the same study found that perceived thought, operationalized in a very similar way to elaborative processing, increased attitude certainty and was a result of putting in cognitive resources. As our definition of reflection as a cognitive task definitely requires more cognitive sources than not doing this task, we infer that reflection could enhance attitude certainty through mobilizing participants to process the information more elaborately. Hence, we propose a hypothesis between reflection and attitude certainty.

H2: More reflection predicts a higher level of perceived attitude certainty.

2.5 Willingness to Express Opinions

Active participation in political discourse is a precondition for democracy. The first step of such engagement is to express one's opinions. In addition to the research on spiral of silence examining the relationship between willingness to express opinions and perceived opinion climate (e.g., [31]), there were several studies testing the relationship between willingness to express opinions and information access. These studies claimed that a higher level of political knowledge (e.g., [30][43]), or better access to mass media, as a proxy measure of political knowledge ([21][49]), led to more opinion expression. However, most findings from these studies were based on cross-sectional surveys, which cannot differentiate the effects of information access from those of reflection. We argue that reflection, in addition to information access, plays a key role in influencing willingness to express opinions. It has been found that attitude certainty [26] and attitude strength [1] positively related to willingness to express opinions. And reflection, by organizing information into a structure and directly contributes to a more consistent and certain attitude, might exert positive influence on willingness to express opinions. Thus, we propose a hypothesis on the relationship between reflection and willingness to express opinions.

H3: More reflection predicts a higher level of willingness to express opinion.

3 EXPERIMENT

A between-subjects online experiment ($N = 168$) was conducted to examine the effects of information access and reflection on perceived issue knowledge, perceived attitude certainty, and willingness to express opinions.

3.1 Design

Our design is a 2×3 between subject design with two independent variables: Information Access { *With, Without* } and Reflection { *No, Low, High* }.

3.1.1 Information Access

At the beginning of the experiment, our 168 participants were assigned to one of the two Information Access conditions: with vs. without such information. Each of these conditions had thus a total of 84 participants. Examples of information (or briefing material) shown to participants are presented in Figure 1.

3.1.2 Reflection

To determine the level of reflection (High vs. Low), participants were first randomly assigned to one of the two conditions: with vs. without reflection (84 in total and 42 in each condition). The degree of High vs. Low reflection was determined after the information access phase, by using a median split to assign participants in either Low (< median number of words in reflection) or High (>= median) reflection. A summary of the number of participants per condition is shown in Table 1. The reflection prompt can be seen in Figure 2.

3.1.3 Statistical Analysis

Dependent variables were measured in a questionnaire after all treatments. Despite that reflection length is a continuous measure, we did not utilize statistical analyses such as regressions to analyze our data. We believe that different levels of reflection result in divergent effects, and these effects might show a pattern that is non-monotonic and non-linear. We thus utilized two-way analysis of variances (ANOVAs) to test the hypotheses.

3.2 Power Analysis

Prior to the recruitment of participants, we conducted a power analysis to ascertain the threshold sample size for a 6-group ANOVA study with effect size 0.5 and power 0.95, where the threshold was found to be 107.

3.3 Participants

A total of 168 participants, who were aged from 21 to 60 and citizens of Singapore, were recruited from Qualtrics' online panel service. By attending our study, they received 6000 points (approx. US\$ 10) from the provider. Of the 168 participants, 89 (53%) were male and 79 (47%) were female, with about one-third of samples aged from 21 to 30 (33%), another third aged from 31 to 40 (33%), and the final third aged from 41 to 60 (34%). Each participant was randomly assigned into one of the experimental conditions (Table 1). They spent 35 minutes on average to finish our study.

Table 1. Number of participants per condition.

	<i>No Reflection</i>	<i>Low Reflection</i>	<i>High Reflection</i>
<i>With Information Access</i>	42	21	21
<i>Without Information Access</i>	42	21	21

As response quality is a valid concern of online experimental studies, we utilized two ways for quality check. Participants who finished our study spending less than one third of median time (i.e., 11 minutes) on the study were not qualified. In addition, we set two attention check question items, which asked participants to select options pre-determined by the researchers. This mechanism guaranteed that the responses were not simply fabricated by machines.

3.4 Task and Materials

We chose one important social challenge that Singapore faces, fertility, as the public issue in this study. Singapore is a developed country with high economic performance and most part of it is heavily urbanized, both of which lead to an expensive environment for raising kids. The fertility rate of Singapore reduced to 1.25 in 2014, far below the lowest replacement fertility rate (2.0) needed to keep up a healthy economy. In addition, an increasing influx of new citizens, which was supposed to solve the low fertility problem, made social integration difficult, and the tension between new citizens and original citizens intensified recently.

We manipulated our independent variables by a 2 (with vs. without information access) × 3 (no vs. low vs. high reflection) between-subjects factorial design. Briefing materials were utilized to manipulate information access. The material was composed of three parts: Basic backgrounds, major problems and trends, as well as current policies and concerns.

One of the Co-PIs of the larger research project, a policy researcher, collaborated with Singapore's National Population and Talent Division (NPTD) to work on the policy briefing materials. The set of policy briefing materials was developed to aim for the general public, with a special emphasis on its accessibility to the majority of the population. All such policy materials have been viewed and advised upon by NPTD, in order to provide accurate and factual information about the topic covered. The policy researcher, along with the project team, paid special attention to making the material balanced and easy to understand.

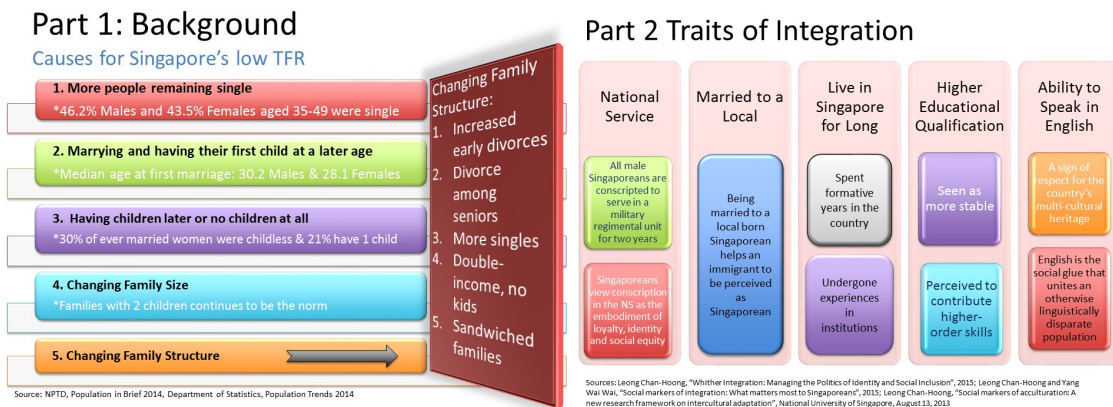


Figure 1. (Left) Example of educational material discussing Singapore's low fertility rate. (Right) Slide discussing integration of new citizens in Singapore. Such content was shown to participants in the *information access* group.

To make sure online participants indeed read those materials, there was a requirement that participants needed to stay for at least 10 seconds on each material page before proceeding to the next one (Figure 1).

Previous studies operationalized intrapersonal reflection as a self-reported measure that asked respondents "how often they try to connect what they see in the media to what they already know and how often they evaluate news stories based on their experience and thoughts" [6], or how much they simulated, collected, and evaluated diverse opinions [48]. The first operationalization of reflection limits reflective activities to processing media content and does not clearly verify how people make the connection between media content and their experience and thoughts. The second operationalization, being a significant improvement, still cannot avoid the pitfalls of self-reported measures. We implemented reflection by asking participants to answer several reflection

questions. These questions asked participants to clarify their own opinions, urged them to put their feet in opponents' as well as policy-makers' shoes to think about the issues, and asked them what they think the reasons behind other people's positions are. For example, in the second section, we asked two open-ended questions, "How might others disagree with you on the fertility issues?" and "What are their reasons?". They have to answer these questions before proceeding to the next section. All of these questions were expected to help participants form more systematic, comprehensive and reflective opinions. Figure 2 shows the UI used for this phase.

Q: What are your opinions on fertility issues?

Enter your reply here!

< Previous slideConfirm Answer >

Figure 2. Reflection Prompt used in the experiment. Participants were invited to answer the question and could then proceed to the next step. This prompt was only shown to participants in the Reflection condition.

3.5 Procedure

Qualtrics provided the platform for this study. Once a participant logged into the study platform, their consent was obtained first. Two screening questions then confirmed that the participant was a citizen of Singapore with age from 21 to 60. Next, several pre-test questions asked about participants' demographic information and measured several political psychological factors. After that, the participant was randomly assigned into one of the experimental conditions. Participants first completed reading of briefing materials (for the conditions with information access only), then answered reflection questions (for low/high levels of reflection only). Next, they were asked to finish a questionnaire. Finally, after completing all parts, the online panel provider compensated those participants, once the researchers confirmed the validities of their responses.

3.6 Dependent Variables

We utilized a questionnaire to measure three groups of dependent variables (perceived issue knowledge, perceived attitude certainty, and willingness to express opinions) and one variable for manipulation check (actual issue knowledge).

3.6.1 Perceived issue knowledge

As our study focused on one specific public issue, issue knowledge instead of general political knowledge was examined here. The level of perceived issue knowledge was measured by a **three-item, seven-point Likert scale** (1 = strongly disagree; 7 = strongly agree). Items included "if someone asks me about fertility issue, I would have enough information to inform him or her", "I am knowledgeable about fertility issue", and "I am

confident about my knowledge about fertility issue" [51] (*Cronbach's* $\alpha = .95$, $M = 4.25$, $SD = 1.23$). Argument repertoire was coded by counting the number of non-redundant arguments regarding each position (either for or against immigration). The ideas produced along the two positions were combined. Redundant arguments that were repeated across positions were counted only once.

3.6.2 Perceived attitude certainty and correctness

We used two separate measures developed by Petrocelli et al. [35] to capture two facets of perceived attitude certainty. **Perceived attitude clarity** was scaled by a **four-item, five-point Likert scale** (1 = not certain at all; 5 = very certain), which included items "How certain are you that you know what your true attitude on fertility issue really is?", "How certain are you that the attitude you expressed toward fertility issue really reflects your true thoughts and feelings", "To what extent is your true attitude toward fertility issue clear in your mind", and "How certain are you that the attitude you just expressed toward fertility issue is really the attitude you have" (*Cronbach's* $\alpha = .94$, $M = 3.48$, $SD = 0.80$). **Perceived attitude correctness** was gauged by a **three-item, five-point Likert scale** (1 = not certain at all; 5 = very certain). Items included "How certain are you that your attitude toward fertility issue is the correct attitude to have?", "To what extent do you think other people should have the same attitude as you on fertility issue", and "How certain are you that of all the possible attitudes one might have toward fertility issue, your attitude reflects the right way to think and feel about the issue" (*Cronbach's* $\alpha = .84$, $M = 3.25$, $SD = 0.77$).

3.6.3 Willingness to express opinions in private and in public

A measure combining **five seven-point Likert scale** items (1 = strongly disagree; 7 = strongly agree) was used to measure participants' willingness to express opinions. Using eigenvalues greater than one and varimax rotation method, a factor analysis revealed two variables: a **two-item scale** of willingness to express opinions in **private** (*Cronbach's* $\alpha = .83$, $M = 5.23$, $SD = 1.13$), and a **three-item measure** on willingness to express opinions in **public** (*Cronbach's* $\alpha = .83$, $M = 4.14$, $SD = 1.27$).

3.7 Manipulation Check

Participants who accessed briefing materials were supposed to show a higher level of actual issue knowledge compared to those without the access. An ANOVA displayed that actual issue knowledge significantly differed for different conditions of information access ($F_{1,166} = 14.49$, $p < .001$). People with access to briefing materials had a higher level of actual issue knowledge ($M = 2.13$, $SD = 1.04$) compared to those without the access ($M = 1.54$, $SD = .99$). These significant results suggested the effectiveness of our manipulation. For reflection, we required all participants in the with-reflection condition to answer every question before proceeding to the next page, which guaranteed the implementation of reflection manipulation. Average response length was 45.16 characters.

4 RESULTS

Given our design with multiple independent and dependent variables, we will summarize the results and focus the analysis on the significant ones.

4.1 Effects on perceived issue knowledge

A two-way ANOVA test was carried out to examine the effects of *reflection* and *information access* on perceived issue knowledge. The main effects of information access and reflection were not significant.

However, there was an interaction between the two variables ($F_{2,162} = 4.93, p < .01, \text{partial } \eta^2 = .06$). Among those without information access, people with low reflection had a lower level of perceived issue knowledge ($M = 3.64$) compared to those with high reflection ($M = 4.74, p < .01$). In contrast, among those with information access, people with low reflection ($M = 4.70$) showed a significantly higher level of perceived issue knowledge compared to those without reflection ($M = 3.96, p < .05$). The interaction is illustrated in Figure 3.

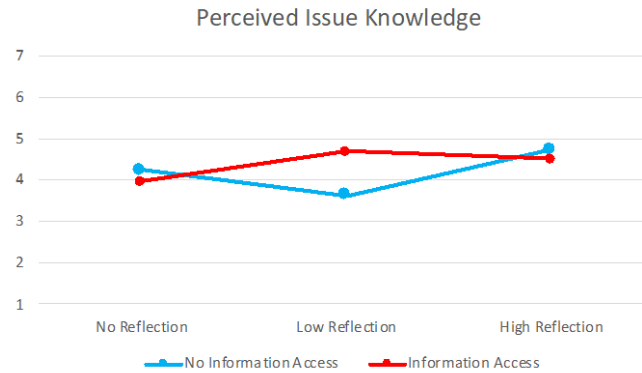


Figure 3. Average Perceived Issue Knowledge across different levels of Reflection and Information Access.

In sum, there were interaction effects between reflection and information access on perceived issue knowledge. Low reflection seemed to lead to opposite results, depending on whether information access is available. **These results substantially supported H1.**

4.2 Effects on perceived attitude certainty

We ran two two-way ANOVA tests to examine the effects of information access and reflection on two sub-constructs of perceived attitude certainty, namely, perceived attitude clarity and perceived attitude correctness.

Regarding perceived attitude clarity, results of ANOVA revealed a significant main effect of reflection on perceived attitude clarity ($F_{2,162} = 3.34, p < .05, \text{partial } \eta^2 = .04$), while no association between information access and perceived attitude clarity was identified. A post hoc test showed that those without reflection displayed a significantly lower level ($M = 3.4, SD = .81$) of perceived attitude clarity compared to those with high reflection ($M = 3.76, SD = .78, p < .05$) while had no difference compared to those with low reflection (see Figure 4).

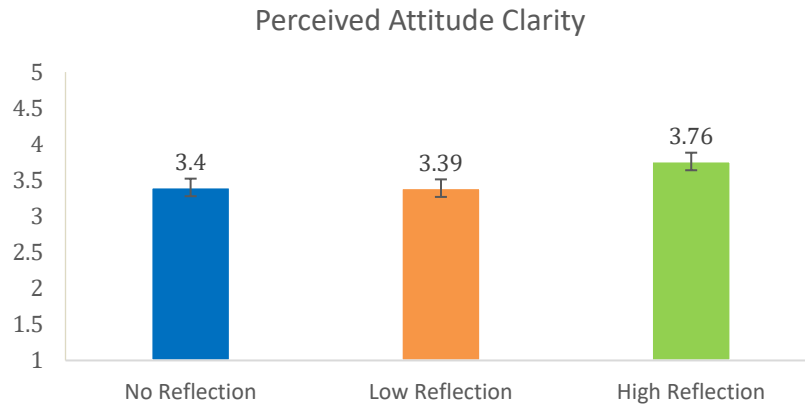


Figure 4. Perceived attitude clarity across different levels of reflection. Error bars show .95 confidence intervals.

The other ANOVA tests referred to the effects on perceived attitude correctness. A significant main effect of reflection was identified ($F_{2,162} = 3.90, p < .05, \text{partial } \eta^2 = .05$), and effects of information access remained nonsignificant. A post hoc test revealed that those without reflection showed a lower level of perceived attitude correctness ($M = 3.1; SD = .77$), compared to those with high reflection ($M = 3.48, SD = .81, p < .05$) while had no difference compared to those with low reflection (see Figure 5). **In short, these results partially supported H2.**

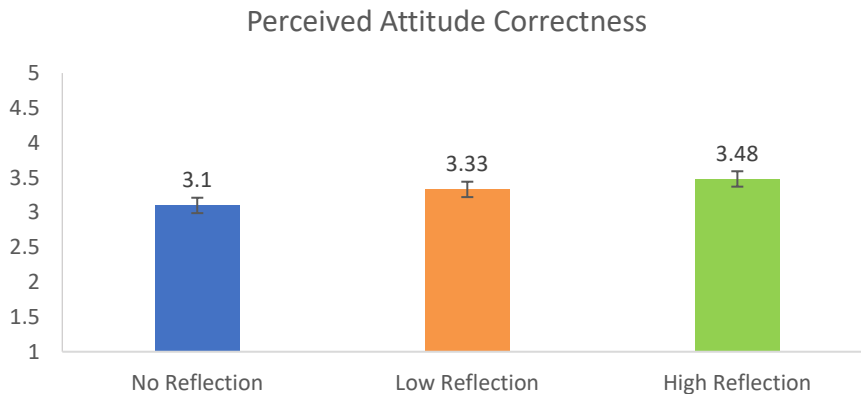


Figure 5. Perceived attitude correctness across different levels of reflection. Error bars show .95 confidence intervals.

4.3 Effects on willingness to express opinions

Two two-way ANOVA tests were run to determine the effects of information access and reflection on willingness to express opinions in private and in public respectively. In private settings, a main effect of reflection was found ($F_{2,162} = 4.01, p < .05, \text{partial } \eta^2 = .04$). In the post hoc test, we found non-significant but close to threshold differences (all $p > .05$ and $< .10$) between people with high reflection ($M = 5.61, SD = .97$) and people with no

reflection ($M = 5.08$, $SD = 1.19$) as well as those with low reflection ($M = 5.11$, $SD = 1.14$) (see Figure 6). On the other hand, in public settings, we found no significant results. Therefore, **H3 was partially supported**.

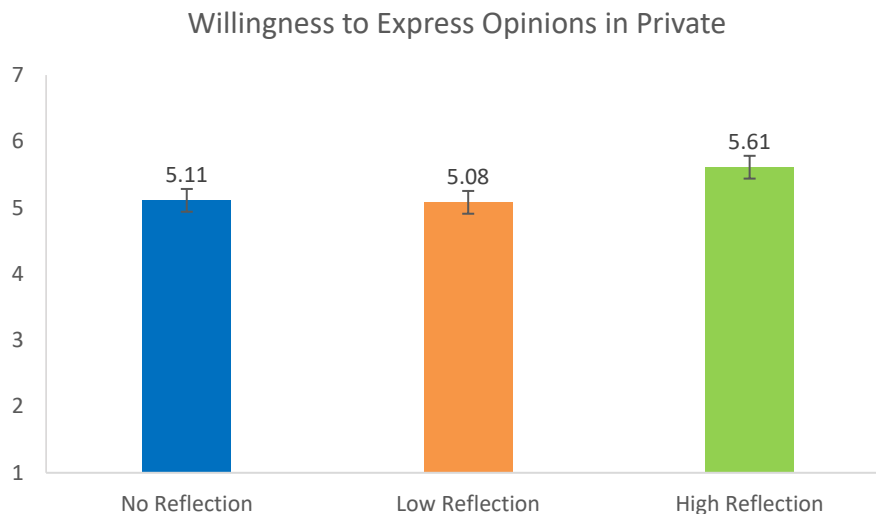


Figure 6. Willingness to Express Opinions (private) across different levels of Reflection.

In summary, **H1 is supported. H2 and H3 are partially supported**.

5 DISCUSSION

We now discuss our results and how they further the knowledge in the field. To summarize, our study did a few things prior studies didn't do – (1) utilized an operationalization of reflection that turns previous self-reports to actual actions; (2) found that reflection only encouraged private opinion expression when previous studies almost never examined the influence of reflection on opinion expression. Our study had one important finding that is inconsistent with previous studies – it is not always true that the more reflection, the better; information access has to be present along with reflection in enhancing perceived knowledge. Our results confirmed one previous finding that reflection enhanced opinion quality.

5.1 Reflection Should be Operationalized

This study contributes to our understanding of reflection in political communication through providing an alternative definition of the concept. Although following the cognitive tradition of conceptualizing reflection (also called “elaborative processing”, or “perceived thought”, or “deliberation within” in prior studies), our efforts went beyond self-reported measures and made people reflect through writing down answers to open-ended questions. These questions were carefully designed to be consistent with normative expectations, which argue for the significance of taking others' perspectives [15]. In addition, our operationalization allowed us to explore non-linear effects of reflection, through dividing participants to no reflection, low and high reflection groups. Such a three-level operationalization has been proved to be highly meaningful, as shown in the interaction results that displayed a U or inverted U pattern. We thus argue that it is necessary for future research to

operationalize reflection using actual treatment instead of perceptions, as well as to allow non-linear relationships to emerge through differentiating reflection into at least three levels.

5.2 Low Reflection for Deliberation

The process of structuring one's opinions through taking both own and others' perspectives makes arguments or lack of arguments explicit to individuals, but only to an extent. Interestingly, both the "exposing ignorance" mechanism and the "strengthening confidence" mechanism were evident among those who were able to come up with low reflection answers, depending on whether they had information access or not. When people did have access to briefing materials, short answers to reflection questions were sufficient enough to give people higher confidence that they are knowledgeable about the fertility issue than those who had high reflection. When people did not access briefing materials, short answers to reflection questions made people realize that they lack necessary knowledge, more so than those with no reflection. Normatively speaking, low perceived knowledge might have some civic virtues, as it prompts scrutinizing new information and systematic thinking, which could foster open-mindedness and political tolerance [32]. Therefore, low reflection might be the most suitable level for the purpose of deliberation, as it makes people aware of their own ignorance when information is not provided but builds their confidence when information is accessible.

5.3 Information Access is Also Important

While the impact of information access on our results may be seen as modest, it adequately highlighted the conditional effect of reflection on perceived knowledge: participants without information access and reflection perceived their political knowledge higher, compared to those participants with low reflection – this suggests an "ignorance is bliss" mechanism working. As such, researchers should provide access to some background information in any deliberation exercises, unless they want to measure an artificially high perceived knowledge of participants.

5.4 Reflection improves Perceived Attitude Clarity and Correctness

Our results confirmed previous findings that reflection enhanced both perceived attitude clarity and correctness. The differences were particularly evident between those with no reflection vs. high reflection, at least with regards to the fertility issue. As certainty constitutes an important dimension of opinion quality [40], our results suggested that reflection may enhance opinion quality, a normatively desired effect for deliberation [3].

5.5 Reflection and Public vs. Private Discussion

We found that people with high reflection were more marginally likely to express opinions in private settings compared to other groups, but showed no difference in terms of opinion expression in public settings. The conscious structuration procedure of reflection might become a test, which indicates to individuals the readiness of their opinions to be expressed to others [38]. Although public opinion expression directly contributes to political discourse, private opinion expression not only facilitates political participation [14][27], but also constitutes an indispensable part of the whole deliberation system [24][55]. Without private political talk, most ordinary citizens might be excluded from contributing to political discourse, as involving in public discourse has higher barriers such as potentially hostile environment. The difference we found in private vs. public opinion expression is consistent with prior studies [43], which suggested that the discussion of political issues among

friends and family is driven by cognitive factors (e.g., reflection) while affective variables such as majority pressures and fear of isolation become the dominant factors for public opinion expression. We can infer that reflection may help future deliberation in the format of talking about the issues with close contacts or in small groups but might not be that impactful in encouraging people to express their opinions in front of a large group of strangers.

5.6 The Complexity of Reflection in Online Discourses

Our results highlight the positive influence of reflection in online discourses, however, that influence is more complex than previously imagined. Reflection's influence on perceived knowledge was higher when working together with information access, suggesting that reflection nudges may need to work with other nudges in order to achieve the best effects in improving online discourses. While reflection did indeed increase attitude quality, it did not encourage opinion expression in a public setting. As such, reflection would be more beneficial within small groups of acquainted people (e.g. online communities where users know each other very well).

5.7 Towards more equal and representative communities

Online discourses cannot be simply viewed as saying whatever one wants to. In order to promote more equal and representative communities, individual online discourses have to be (more) reflective, going beyond sharing our own views by taking the perspectives of others, including our opponents. After forming the habit of constantly checking our own assumptions and understanding others, it becomes possible that polarized groups might be bridged. Using reflection nudges is a small step towards the grand goal of improving diversity of views we hear to help us burst filter bubbles we live in. Even if our echo chambers currently do not include people we disagree with, pause for a moment and ask ourselves, what someone who disagrees with us might think about this issue?

6 IMPLICATIONS FOR OTHER CONTEXTS

The task presented in this experiment was very specific and done in an online deliberation context. We do believe that the effect of our examined factors could also be leveraged in other contexts. We do acknowledge that more work would need to be done and would like to suggest future research direction for researchers in slightly different fields.

6.1 Online Forums

On online discussion platforms (e.g., reddit), reflection nudges coupled with brief background information could be plugged in before allowing users to post replies on sensitive or controversial topics, to avoid the bias of high perceived knowledge induced by no information access and absence of reflection. For instance, users can be shown a summary of previous posts on the topics (e.g., with % of supporting vs. opposing views) and asked to post replies with either supporting or opposing users in mind. This could potentially lead to higher quality of opinions and eventually, higher quality of discussion.

6.2 Review Interfaces

Reflection nudges could be implemented on review interfaces (e.g., TripAdvisor and Google reviews), too. Before allowing users to post a review, users can be presented with a summary of existing reviews (e.g., most frequent keywords and sentiments) and asked to post replies that explicitly contain both pros and cons (e.g.,

two reply areas). As we found that reflection enhances attitude certainty and correctness, such reflection nudges could improve the quality of not only the said review but also the users' attitudes towards the said premise. This may potentially help businesses and entities being reviewed to gain more quality reviews and less bullying spams. Moreover, we found that high reflection enhanced willingness of opinion expression in private and such reflection nudges may help businesses and entities being reviewed to build their reputation through word-of-mouth communication.

6.3 Technology Ethics Review

Technology developers often face the dilemma of agile design and understanding users. Participatory design that extensively involves users is easier said than done. However, the ethical crisis is real when important technologies (e.g., AI governance) do not fully take diverse views into account. Our reflection nudge can be repurposed into the design procedure by prompting designers to reflect on their own design decisions, taking the perspective of opposing stakeholders such as marginalized users (e.g., the elderly) or regulators (e.g., out of privacy constraints). The three simple questions can be inserted as a quick practice that is part of each work meeting the designers hold.

7 LIMITATIONS

All studies have limitations. This one is not an exception. We still lack a thorough understanding on effects brought from different reflection levels. Although the general pattern that reflection seemed to function in a non-linear manner was found with perceived issue knowledge, we do not have enough evidence to explain why such a non-linear pattern did not show up in other dependent variables. More empirical studies are needed to find out whether such interaction patterns persist with other samples of participants. Future studies should endeavor to comprehensively investigate the effects of reflection of different levels.

Method wise, the experimental design here substantially improved internal validity compared to cross-sectional surveys, while external validity was attempted by putting the experiment on an online survey website and recruiting participants of both gender and a wide range of age. However, our findings are still limited in terms of their generalizability for two reasons: The specific issue examined here and the context of Singapore. We focused on the fertility issue, which could differ significantly from other issues along many dimensions such as level of controversy. Also, the context of Singapore could be unique, such as its hybrid political system and mixed culture [53][54].

Future studies should examine how the political issues themselves interact with other factors, and identify which feature of the issue (e.g., controversial or relational) matters, and why it matters. Our examination also needs to be replicated in other countries to reveal the conditional impact of contexts.

8 CONCLUSION AND FUTURE WORK

This study sheds light on both the general studies of online public discussions and the specific research area of online deliberation. Reflection is normatively desired by deliberation theorists as it prompts people to rethink their own original opinions and prepare to take others' perspectives into consideration [3][15].

Our study provides an alternative definition of the concept. We also provide empirical evidence to support the three effects of reflection: Firstly, small amount of reflection exposes ignorance for those without information access while builds confidence for those with information access; secondly, reflection enhances perceived

attitude certainty; lastly, reflection promotes willingness to express opinions in private. We believe that reflection as an intrapersonal communication component and its nuanced and substantial roles in online public discussions are yet to be fully discovered. Reflection nudges should also be made to help technology developers to take non-designers' perspectives to make design more ethically responsible.

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