Observation versus Perception in the Conceptualization and Measurement of Participation Equality in Computer Mediated Group Decision Making

Abstract

Participation equality, a prominent construct that has received much attention in group decision making research, has been studied with both perceptual and objective measures. Yet research findings regarding participation equality have been inconsistent and equivocal. We argue that one reason for this inconsistency is how participation equality has been conceptualized and measured. In some studies, researchers have theorized and measured participation equality using observed behavior. In other studies, researchers have theorized and measured participation equality using perceptual measures. We conducted an experiment to investigate the similarities and differences between these two measures. Our results indicate that 1) perceptual participation equality (PPE) and observable participation equality (OPE) are theoretically separate and distinct constructs that 2) affect and are affected by other constructs in different ways within their nomological network. OPE and PPE were more different than they were similar, sharing only 10.8% of their variance. In other words, perceptions of participation equality were predominantly influenced by factors other than observed behaviors related to participation equality. We believe these results call for more theory and research regarding the differences between observable behavior and perceptions of behavior in group decision making. As we move into new computer-mediated communication technologies such as Web Conferencing, Virtual Reality, and Enterprise Social Media that enable new forms of participation, we need to consider what constitutes participation and how new forms of participation should be measured and evaluated. In the large group environments of Enterprise Social Media, the differences between OPE and PPE are likely to become more pronounced.

Keywords: participation equality, group decision making, collaboration technology, virtual groups, virtual teams, computer mediated communication, process satisfaction, decision satisfaction, anonymity

INTRODUCTION

"*My reality is just different from yours.*" — Lewis Carroll

Globalization and rapid technological advancements have led to the widespread use of virtual groups for decision making in organizations (Dulebohn and Hoch, in press; Gilson et al. 2015). Surveys show that virtually every large organization uses virtual groups, and the percentage of groups that are entirely virtual (i.e., never meet face-to-face) has increased over time, from 33% in 2012 to 48% in 2016 (Solomon, 2016). Some organizations have announced policies to increase the number of entirely virtual meetings in an attempt to reduce travel costs and support "go green" initiatives. For example, several Swedish public agencies now encourage virtual meetings and as a result average more virtual meetings than face-to-face meetings

(Arnfalk, et al. 2016). Research on virtual groups has long had a prominent place within the Information Systems discipline, and other disciplines are also recognizing the importance of virtual groups to their future research agendas (Gilson, et al., 2015). For example, the recent editorial in the *Academy of Management Journal* (Colbert, Yee, and George, 2016), and the special issue in *Human Resource Management Review* (Dulebohn and Hoch, in press) calls for more research on virtual group collaboration.

Virtual groups can communicate through a variety of technologies, such as text-based computer mediated communication (CMC), audio and video, and virtual reality (Gilson et al. 2015). Text-based CMC, in particular is common with 94% of employees using it for work-related purposes and tasks (Torres and Conaway 2014). Virtual groups enable organizations to pool diverse expertise from a wide variety of perspectives (Maynard et al. 2012), but only if group members actually participate in the decision making process.

As virtual collaboration moves to new CMC tools such as Web Conferencing (WC), Virtual Reality (VR), and Enterprise Social Media (ESM), participation continues to be a major issue (Durr, et al., 2016; Stewart and Shamdasani, 2017; Solomon, 2016; Wang, et al., 2014). WC (e.g., Google Chat, Google Hangouts, Google Docs, WebEx) bears the closest resemblance to prior CMC technologies because these commercial tools evolved from the mix of asynchronous text, synchronous text, audio, and video communication that has been studied for decades. VR (e.g., Second Life, Open Wonderland, Oculus Rift) offers a few differences from traditional CMC technologies because video interaction is provided via avatars and not directly through a camera. ESM (e.g., Linked In, Yammer, Connections, eXo) is typically text-based so it too, has some resemblance to text-based CMC tools. However, ESM, by its massive scale and scope is dramatically different. Some ESM supports interaction for large, loosely-knit groups (e.g., 100 or 1,000 members) spread over large distances (Warshaw, et al., 2016) as opposed to small groups (e.g., 5 members) with a shared task that is typical of virtual groups using WC and VR. In sharp contrast to small groups using

CMC, WC, or VR, the majority of ESM participants often never contribute a comment (Muller, 2012).

In this study, we focus on participation equality in small groups working on a shared task using the line of CMC technologies that began in the 1980s and has evolved into the commercial WC tools commonly used today. Although ESM tools are functionally similarly to many text-based WC tools, the context of their use (large groups without a common shared task whose members seldom contribute comments) gives the construct of participation equality a fundamentally different meaning in ESM settings that it has in WC or VR.

The opportunity for more equal participation is often cited as an important contribution of CMC that leads to better decision making (Fjermestad and Hiltz 1998-99; Fjermestad and Hiltz 2000-2001; Nunamaker et al. 1991; Sunstein and Hastie 2014). A lack of participation can pose a frustrating problem for virtual groups (Solomon, 2016) and those using ESM (Durr, et al., 2016). Under certain conditions, more equal participation enables contributions to decision making to be shared among individuals who may otherwise be unequal with regard to influence, status or power (Dennis and Garfield 2003) which may lead to better decisions (Fjermestad and Hiltz 1998-99; Fjermestad and Hiltz 2000-2001; Nunamaker et al. 1991). An often cited proposition has been that groups with more equal participation will produce more diverse viewpoints, generate more informed and creative solutions (George et al. 1990; Straus 1997) and generate other desirable group outcomes such as increased decision satisfaction (Dennis and Garfield 2003). A meta-analysis of 145 studies indicates that participation equality is an important factor that helps explain why CMC use leads to better or worse decision outcomes (Fjermestad 2004).

Yet, a recent review of research reveals that empirical findings regarding participation equality have been inconsistent and equivocal (Reinig and Mejias 2014). As compared to face-to-face (FTF) communication, some studies report that CMC increased participation equality (e.g., Dennis and Garfield 2003; Straus 1997; Weisband 1992), while other studies report that CMC had no effect (e.g., Bresciani and Eppler 2009; Hatem et al. 2012; Smith et al. 2012) or decreased participation equality (e.g., Berdahl and

Craig 1996; Daily and Teich 2001). One possible explanation for these inconsistent research findings may be the method by which participation equality has been conceptualized and measured. Researchers have historically used either observable participation equality or perceptual participation equality. *Observable* participation equality (OPE) is conceptualized as an objective property of the group's collective behavior and is measured by observing the overt behavior of group members as they participate in the decision making process. *Perceptual* participation equality (PPE) is conceptualized as a subjective perception of the group's deliberations and is measured by asking group members to subjectively assess the equality of their participation in the decision making process.

To what extent are OPE and PPE similar and do they behave in a similar fashion within their nomological network? Individual's *perceptions* of one's own behavior and performance do not always accurately reflect their *observed* behavior and performance (Farh and Werbel 1986; Harris and Schaubroeck 1988; Mabe and West 1982; Rich et al. 1999). This inconsistency is especially true when group members are asked to compare themselves to their peers (Kruger and Dunning 1999). If PPE is conceptually and closely related to OPE, then the two constructs should perform similarly in the wider nomological network of independent and dependent constructs. That is, the independent constructs that affect participation equality and the dependent constructs that are affected *by* participation equality should display similar effects, regardless of whether OPE or PPE is used. However, if PPE and OPE are not closely associated, the differences between these two constructs may explain some of the inconsistencies in past research findings regarding participation equality.

We begin with a review of how the participation equality construct has been conceptualized and measured in prior research and hypothesize that OPE is a separate and distinct construct from PPE. We then describe the methodology to test these hypotheses by employing both observable and perceptual measures of participation equality. We conclude by presenting our results and implications for virtual groups using traditional group tools, as well for some of the newer forms of CMC, such as WC, VR, and ESM. How does what we have learned about participation equality in prior FTF and CMC research provide decision making guidance for work groups using new CMC tools such as WC, VR, and ESM?

PRIOR THEORY AND RESEARCH

A review of CMC research reveals notable differences in the *conceptualization* and *measurement* of the participation equality construct. Participation equality has been labeled equality of participation (Kiesler et al. 1984; Smith et al. 2012), inequality of participation (George et al. 1990; Janseen et al. 2007), centralization of task participation (Berdahl and Craig 1996), equality of contribution to decision (Daily and Teich 2001), equality of participation sharing (Hatem et al. 2012) and equality of member participation (Haines et al. 2014). Table 1 provides a brief summary of prior research that focuses on the constructs of interest in our current research. This table lists prior research that has examined participation equality (OPE and/or PPE), the CMC technology used (whether the CMC provided anonymity and/or identified the authors of comments), and three outcomes (consensus, satisfaction with the process, and/or satisfaction with the decision). The check marks indicate that the construct was included in the study. Appendix A provides more details on each study.

Conceptualization of Participation Equality

Participation equality has been conceptualized in various ways within different studies, and not all studies have been explicit about their conceptualization. Therefore, we begin by first reviewing the various *measures* of participation equality used in past CMC research to develop the underlying conceptualization and operationalization of the participation equality construct. Most measures are either *observable* (i.e., what group members actually do) or *perceptual* (i.e., what group members perceive that they do). Few studies have used both measures of participation equality in their methodology (e.g., Jarvenpaa et al. 1988).

Table 1. Summary of Prior Participation Equality Research and Outcomes

		CMC Technology		Participation Equality Measure		Outcomes		
Participation Equality Study	Year	CMC-A	CMC-I	OPE	PPE	Consensus	Process Satisfaction	Decision Satisfaction
Kiesler, et al.	1984	✓	✓	✓		✓		
Hiltz, et al.	1986	✓		✓		✓	✓	
Siegel, et al.	1986	✓	✓	✓		✓		
Jarvenpaa, et al.	1988	✓	✓	✓	✓		✓	
Hiltz, et al.	1989	✓	✓	✓		✓		
George, et al.	1990	✓		✓			✓	
Poole, et al.	1991	✓		✓				
Dubrovsky, et al.	1991		✓	✓				
Lea & Spears	1991	✓		✓				
Tyran, et al.	1992	✓			✓			
McLeod & Liker	1992		✓	✓			✓	
Weisband	1992	✓		✓				
Burke & Chidambaram	1995	✓			✓			
Weisband, et al.	1995	✓	✓	✓				
Walther	1995		✓		✓			
Berdahl & Craig	1996	✓			✓			
Straus	1996	✓		✓		✓		✓
Mejias, et al.	1996	✓	✓		✓	✓		✓
Straus	1997		✓	✓				✓
Daily & Teich	2001	✓			✓			
Dennis & Garfield	2003	✓			✓		✓	
Janssen, et al.	2007	✓		✓				
Bresciani & Eppler	2009	✓			✓		✓	✓
Smith, et al.	2012	✓		✓			✓	✓
Hatem, et al.	2012		✓	✓				
Reinig & Mejias	2014	✓	✓	✓				
Haines, et al.	2014	✓	✓	✓				

Note: Checked areas show constructs examined. CMC-A=Anonymous Computer-Mediated Communication; CMC-I=Identified Computer-Mediated Communication; OPE=Observable Participation Equality; PPE=Perceived Participation Equality. For a detailed description refer to Appendix A-2.

Observable participation equality (OPE) is a group-level measure of the degree of variability in the distribution of observed participation units generated by participants during group decision making discussions. To compute observable measures, researchers typically define a unit of participation and then record frequency counts for each participant. Observable behaviors may be text output or verbal output, or some combination of both (e.g., remarks, turns, comments, utterances, lines of text, and number of words) (George et al. 1990; Haines, et al., 2014; Reinig and Mejias 2014). OPE may also consider visual output (i.e., gestures, facial expressions) but this output is not commonly measured. OPE is then calculated as the relative distribution of participation units among group members, such as the GINI coefficient (Haines et al. 2014; Reinig and Mejias 2014). Therefore, OPE is participation equality conceptualized in terms of the distribution in the relative quantity of certain observable communicative behaviors among group members. A limitation of OPE is that it reflects only one dimension of participation (i.e., the relative quantity of output) and may fail to capture other dimensions of participation, such as listening.

Perceptual participation equality (PPE) is an individual-level measure and is typically collected via post-session questionnaires where participants self-report how equally they perceived participation was distributed among their group members (Bressciani and Eppler, 2009; Daily and Teich, 2001). PPE differs from OPE in three significant ways; one methodological and two theoretical.

First, from a methodological perspective, most PPE questions assume the perspective of a disinterested observer and participants may not always assume that role. During a virtual or FTF setting group discussion, participants' cognitive focus is on the decision task at hand and not on assessing participation equality. Participants are typically not informed ahead of time that they will be asked to assess their participation equality, so participants are unlikely to devote their attention to assessing participation equality during the related group discussion. Of course, if studies were to inform participants *a priori* of such an assessment, participants could be unduly sensitized to participation equality and may behave differently.

Therefore, PPE measures may not accurately reflect actual, overt behavior as is measured by OPE (e.g., Farh and Werbel 1986; Harris and Schaubroeck 1988; Mabe and West 1982).

Second, from a theoretical perspective, perceptual measures of participation equality enable participants to expand their interpretation of participation beyond observable behavior to include such activities as listening (Zigurs et al. 1988), involvement (Pinsonneault et al. 1999), and participativeness (Dennis and Garfield 2003) that may not be captured by OPE measures.

Third, participation equality may not generate the same theoretical meaning to participants as it does to researchers. Researchers tend to view participation equality as an objective measure, based upon whether observable participation behavior (however measured) was truly equal. However, not every participant's contribution may be equal; some contributions may have more impact on group decisions than others. Likewise, not all group members, whether in a virtual or FTF setting, may desire to participate to the same extent as other participants (Straus 1997). This is particularly true of individuals using ESM, where 90% of ESM participants choose to never contribute a comment (Muller, 2012).

Thus equal participation behavior may not occur even when each group member has participated as much as they desire. For example, there may be a particular issue that a group member may want to ensure is understood by the rest of the group and becomes more engaged in the group decision process. However, that particular group member may have no information or participative interest in other aspects of the decision process (Muller, 2012). So if group members were able to actively engage in an issue that was of particular importance to them, and abstain from participating in other issues, would they consider their participation to be equal? If group members participated as much as they wanted, but not to the same extent as others, that particular group member may still perceive their participation to be equal. Some measures of PPE have clearly framed the participation equality construct as the ability to participate at the level *desired* by the participant (e.g., Jarvenpaa et al. 1988). Even if survey questions used to measure PPE are not presented in this manner, participants may, consciously or not, still adopt this frame of reference. Thus, PPE poses to be a theoretically different and distinct construct from OPE in situations where participants possess different levels of desired participation (Straus 1997).

In essence, OPE focuses on an objective reality, while PPE focuses on a subjective perception of reality. Subjective perceptions of reality may differ from objective reality even if only one of the above three arguments apply. From our viewpoint as critical realists (Mingers et al. 2013), the understanding of an objective reality, as separate and distinct from the understandings of the subjective realities of participants, is common and ordinary part of research (Weber 2004). We do not privilege the objective over the subjective, nor vice versa. OPE is neither inherently better nor worse than PPE. Our point is that past research has often been unclear and equivocal on which form of participation equality is the construct of interest (Burke and Chidambaram 1995; Daily and Teich 2001; Reinig and Mejias 2014).

Prior Research on Participation Equality

Our review of past research indicates that the most frequent research proposition is that groups using CMC will exhibit greater participation equality than groups using FTF communication. However, research findings regarding this proposition however, continue to be inconclusive and inconsistent. CMC was found to increase participation equality relative to FTF in a majority of cases, although some research reports that CMC either had no effect on participation equality (e.g., Bresciani and Eppler 2009; Hatem et al. 2012; Smith et al. 2012) or that CMC generated less participation equality relative to FTF (e.g., Berdahl and Craig 1996; Daily and Teich 2001).

We also examined the use of OPE versus PPE. In 18 studies that used only OPE measures, a majority reported that CMC increased participation equality relative to FTF communication. Of eight studies that used only PPE measures, six reported that CMC increased participation equality relative to FTF while two studies reported less participation equality or no difference compared to FTF. One study that used both

OPE and PPE measures found that CMC had no effect on participation equality (Jarvenpaa et al. 1988).

Researchers have also compared various configurations of CMC such as anonymous and identified CMC environments (Haines et al. 2014). Identified CMC, where the real name of the author is appended to their contributions, is commonly found in commercial WC tools (e.g., Google Chat, WexEx). Likewise, anonymous CMC interaction, where the author's name is not attached to their contributions, is also commonly found in commercial WC tools (e.g., Google Docs, Google Sheets). Some tools provide anonymity for particular types of contributions, but identify the author of other types of contributions (e.g., Janssen, et al., 2007). In many cases, commercial WC tools (particularly, social media tools) enable the use of pseudonyms or "anonymous pen names" (Hiltz, et al. 1989), by permitting users to choose non-identifying names to attach to their contributions. The pseudonym can be deliberately chosen by the user to either clearly identify themselves, or to obscure their real identity which offers an important form of anonymity (Stewart and Shamdasani, 2017).

Anonymity is a continuous construct, not a binary one. That is, even if names or pseudonyms are not explicitly attached to comments, participants may still have some ability to identify the author (Hayne, et al., 2003). Although some studies have found anonymous CMC to increase participation equality (e.g., Dennis and Garfield 2003; Straus 1996; Weisband 1992), other studies found no effect (e.g., Haines et al. 2014; Smith et al. 2012; Weisband et al. 1995), or that anonymous CMC decreased participation equality (e.g., Berdahl and Craig 1996; Daily and Teich 2001).

The relationship between participation equality and CMC outcome variables such as *consensus, process satisfaction,* and *decision satisfaction* also appeared to be related to the particular participation equality measure that was used. When *observable* measures of participation equality were used, higher participation equality was associated with lower consensus (George et al. 1990; Hiltz et al. 1986), more time to reach consensus (Dubrovsky et al. 1991; Siegel et al. 1986; Weisband 1992), lower process satisfaction

(Hiltz et al. 1986; Straus 1996; Straus 1997) or had no effect on process or decision satisfaction (Smith et al. 2012). When perceptual measures of participation equality were used, higher participation equality was associated with lower consensus (Straus 1996), higher decision satisfaction (Dennis and Garfield 2003) or had no effect on process or decision satisfaction (Bresciani and Eppler 2009).

These prior research findings illustrate the diverse range in the conceptualization and measurement that researchers have employed in CMC research with regard to the participation equality construct. The body of this research also illustrates the considerable inconsistency in research findings with regard to the effects of CMC on participation equality and the effects of participation equality on group decision making and other outcomes. These inconsistencies may be partially explained by the failure of researchers to clearly distinguish between observable and perceptual conceptualizations of participation equality. We argue that because OPE and PPE are theoretically distinct constructs, that measures of OPE, which are based upon observable behavior and measures of PPE, which are based upon subjective perceptions of participation equality, will be only modestly associated with each other and will vary from each other in their associations with other variables in the nomological network. Thus, we do *not* expect OPE and PPE measures to reflect a single underlying factor or to relate to their antecedents and consequences in a similar manner. Therefore:

> **H1. A measurement model representing observable participation equality and perceptual participation equality as separate constructs will have a superior fit when compared to a measurement model with observable participation equality and perceptual participation equality as indicators of a single construct.**

Effects of CMC Use on Participation Equality

If OPE and PPE represent the same underlying construct, we would expect that they would demonstrate similar behavior within the larger nomological network of constructs (MacKenzie et al. 2011). Conversely, if they are different, then constructs in the nomological network would be affected differently by OPE and PPE (MacKenzie et al. 2011). For any given group decision or collaborative situation, an individual will aspire to a their desired level of participation (Straus 1997; Muller, 2012). Within FTF environments, process losses such as production blocking (i.e., the inability for more than one person to speak at once) and dominance (i.e., one or more participants insist on monopolizing the discussion) impose limits on participation (Straus 1997). CMC environments reduce production blocking and dominance by providing parallel communication as participants do not need to wait for a turn to speak and are not dominated by other group members within a group discussion (Nunamaker et al. 1991). Thus, from a purely technological point of view, CMC removes certain limitations that reduce participation and creates the opportunity for more equal participation.

The key question is whether group members, *choose* to participate in group discussion process when presented with the opportunity. CMC does not *cause* participation to be more equal; it creates the *opportunity* for participation to be more equal (Nunamaker et al. 1991). Whether or not participants choose to take advantage of the opportunity to participate, created by the reduction of production blocking, dominance or other process losses is another question (Dennis and Garfield 2003). Without limitations or obstacles to participation, individuals may naturally participate to whatever extent they desire, with some individuals desiring to participate more than others (Straus 1997). The extent to which people participate when given the opportunity, is influenced by whether they believe they have useful information to contribute (Dennis 1996) and how they perceive their contribution will be received (i.e., people may hesitate to contribute viewpoints that contradict the group majority) (Nunamaker et al. 1991).

One of the often cited advantages of CMC is that it enables the use of anonymity in the group decision process. The opportunity for virtual group members to submit comments and information anonymously can reduce group process losses such as evaluation apprehension and dominance (Dennis and Garfield 2003; Reinig and Mejias 2014; Stewart and Shamdasani, 2017). The use of anonymous CMC has been found to lead to greater participation equality than identified CMC (Hiltz et al. 1986; Mejias 2007; Nunamaker et al. 1991; Straus 1997; Tyran et al. 1992; Weisband et al. 1995). Anonymous CMC has been shown to encourage group members to participate more than they otherwise would within a FTF setting (Haines et al. 2014; Nunamaker et al. 1991; Straus 1996).

Both anonymous and identified CMC environments create opportunities for equal participation so both would be expected to increase participation relative to FTF communication. However, anonymous CMC may have a stronger effect than identified CMC in settings where participants are concerned how their comments will be received by other group members (i.e., evaluation apprehension), thus resulting in greater OPE. In contrast, while the use of identified CMC may also encourage more participation and more OPE than FTF settings, participants may be more likely to self-censor their comments and limit their contributions than anonymous CMC. Therefore:

H2. The use of anonymous CMC will lead to a) greater observable participation equality and b) greater perceptual participation equality than face-to-face communication.

H3. The use of identified CMC will lead to a) greater observable participation equality and b) greater perceptual participation equality than face-to-face communication.

H4. The use of anonymous CMC will lead to a) greater observable participation equality and b) greater perceptual participation equality than identified CMC.

Effects of Participation Equality on Group Decision Making Outcomes

If OPE and PPE reflect the same participation equality construct, we would expect that they should generate similar effects on other constructs in the larger nomological network of group work (MacKenzie et al. 2011). A meta-analysis of 145 experiments (Fjermestad 2004) indicates that participation equality has been theorized as an important process variable (i.e., mediator) in various input-process-output models that depict how CMC influences group outcome variables such as consensus (Poole et al. 1991) and satisfaction (McLeod and Liker 1992; Straus 1997). For our study, we focus on three outcomes that prior research suggests are affected by participation equality: consensus, process satisfaction, and decision satisfaction (Fjermestad and Hiltz 1998-99; Fjermestad and Hiltz 2000-2001). There are, of course, other important variables such as decision quality, but not all tasks and decisions may have correct answers. Thus, these three outcomes apply to a broad range of tasks (Fjermestad and Hiltz 1998-99; Fjermestad and Hiltz 2000-2001).

There are two competing theoretical viewpoints on the effects of participation equality. The first suggests that increased participation equality should be associated with greater process and decision satisfaction as participants are influenced by how involved they were in the decision process and whether their contributions were reflected in the decision (Dennis and Garfield 2003). Thus, as participation becomes more equal, satisfaction may increase (Straus 1997). Likewise, when participants have greater opportunities for more equal participation, consensus should be stronger (Burnstein and Vinokur 1973).

The second theoretical view suggests different conclusions. As participation equality increases, more input and opinions will be offered into the group decision process (Hiltz et al. 1986; Poole et al. 1991). A greater number of opinions however, may increase the likelihood that opposing opinions will surface making it more difficult for participants to consider each opinion in detail (Hiltz et al. 1986), thereby increasing the possibility for conflict (Poole et al. 1991; Straus 1997). Conflict may be more difficult to manage in CMC as compared to FTF environments as the parallel communication inherent in CMC make it more challenging for participants to focus their discussion on a single issue and resolve differences of opinions (Nunamaker et al. 1991). CMC also tends to engender the expression of more negative emotions (particularly “flaming”), which is more pronounced for anonymous CMC than identified CMC environments (Dubrovsky et al. 1991; Poole et al. 1991; Reinig and Mejias 2004). Thus, it may be more difficult to reach consensus as participation equality increases (Hiltz et al. 1986; Poole et al. 1991).

Satisfaction with the decision is the degree to which group participants perceive that the group decision had addressed certain requirements in the attainment of their individual goals and desires (Mejias 2007; Straus 1996 and 1997). Satisfaction with the process is the degree to which the group process was perceived to be fair, understandable and satisfying in contributing value to an individual’s goals (Poole et al.

1991; Reinig 2003). As it becomes more difficult to reach consensus and group conflicts emerge, group decision outcomes may be less likely to match each group member's expected desires and satisfaction may decrease. Thus, as participation equality increases, satisfaction with the group decision and group process may decrease. Interestingly, empirical research supports both viewpoints. Studies using OPE have found that higher observable participation equality is associated with lower consensus (George et al. 1990; Hiltz et al. 1986; Poole et al. 1991) and lower process satisfaction (Hiltz et al. 1986; Straus 1996; Straus 1997). Yet other studies using PPE have found higher PPE associated with higher decision satisfaction (Mejias 2007).

We believe both theoretical viewpoints are accurate depending on the context and whether PPE or OPE is the construct of interest. The first theoretical viewpoint is *internally* focused upon each group participant. Results hinge upon "my" participation and how I feel about it; did I get to participate to the extent that I wanted? As each participant possesses a different level of desired participation (Straus 1997; Muller, 2012), it is unlikely that each group member will aspire to participate in such a manner that participation is mathematically equal for all participants. From this theoretical viewpoint, mathematical equality in OPE is irrelevant to the participant. It only matters whether each group member was able to participate as desired and whether the participant perceived that the group acknowledged their contribution. The level of participation by other group members may not matter, unless that participation impinges upon their own participation, which does not occur within the parallel communication environment of a virtual CMC. Further, the perception of participation equality is more likely to occur under conditions with less conflict and more agreement. This suggests believe that perceptions of participation equality are associated with higher consensus levels. That is, if the majority of the group stands in opposition to one's own position, then that group participant may be less likely to report being acknowledged and received equally, regardless of the actual participation or distribution of comments from the rest of the group. This theoretical viewpoint is inherently a perception of one's own participation and does not reflect actual participation that occurred within the discussion. Thus:

H5. Higher perceptual participation equality will be associated with a) higher consensus, b) higher decision satisfaction and c) higher process satisfaction.

In contrast, the second theoretical viewpoint is *externally* focused. It is based on the consequences of collective behavior. As we argued above, if all participants contribute equally to the group decision process, there will be more opinions to consider, making it more difficult for the group to consider each viewpoint in detail, thus increasing the possibility for conflict (Hiltz et al. 1986; Poole et al. 1991; Straus 1997). High-status members typically exert control over the communication within the group decision process and are able to substantially influence the decisions made by the group (Johnson et al. 1996). CMC reduces the influence of high status members, making it more difficult to resolve conflict (Poole et al. 1991) and reach agreement, and is therefore associated with lower consensus and satisfaction levels. Indeed, the very purpose of a CMC environment is to mitigate the hierarchical and status disparity among group participants. Yet, equal participation may undermine the ability of high-status group members to bring their group to consensus. Although increased participation equality may be useful for idea-generation and creativity tasks, it generates additional challenges for decision making and consensus-seeking tasks (as in the present study). Therefore:

H6. Higher observable participation equality will be associated with a) lower consensus, b) lower decision satisfaction and c) lower process satisfaction.

METHODOLOGY

Participants

We tested our hypotheses using data from 258 undergraduate business students assigned to thirty-three groups. Twenty-eight groups had eight members and five groups had seven members. Although the use of equal group sizes is ideal, CMC researchers have frequently used slightly unequal group sizes in their studies (e.g., Dennis and Garfield 2003; Haynes et al. 2014; Mejias, 2007; Reinig and Mejias, 2014; Tyran et al. 1992; Watson et al. 1988). A *t*-test found no significant difference in participation equality scores between the seven- and eight-member groups.

Experimental Task

The groups completed a decision-making task that required participants to act as members of a community task force. The task was a modification of the "Foundation task" used in previous CMC research by Poole et al. (1991) and Watson et al. (1988). Prior to group discussion, group members ranked nine philanthropic projects for potential funding. The projects were designed to appeal to different motives (e.g., social, aesthetic, religious). Therefore, there was no correct ranking order for this experimental task. The first ranking generated an initial group consensus statistic. Participants then worked as a group to discuss the relative merits of each project for 30 minutes using CMC or FTF communication. After the discussion, participants individually rank-ordered the nine projects a second time, producing a second consensus statistic.

Experimental Treatments

Groups were randomly assigned to one of three experimental treatments;

Face-to-Face (FTF*):* Participants interacted within a traditional FTF environment and used name cards with their real names so that the identity of the person making verbal comments was known to the others.

Identified CMC: Participants used their *real names* (i.e., first name and surname) as their login names so that the identity of the participant was known to the rest of the group. Each participant's real name was automatically appended to the end of each comment submitted to the electronic discussion.

Anonymous CMC: Participants selected *anonymous pen names* (Hiltz et al. 1989) as their login names so that the identity of the participant was unknown to the rest of the group. Anonymous pen names were automatically appended to the end of each comment submitted to the electronic discussion.

Anonymity is a continuous construct because participants have some ability to identify the author of a comment, even when no name is attached to it (Hayne, et al., 2003). The use of anonymous pen names provides one level of anonymity as it enables users to link comments to authors during a meeting providing the potential for a more coherent discussion. However it is still less anonymous than completely unidentified comments (Rains and Scott, 2007).

Experimental Procedures

Participants were randomly assigned to an anonymous CMC, identified CMC or FTF treatment. Participants then completed the experimental task described above and their comments were recorded. After a post-task questionnaire was completed, participants were debriefed and released.

Measures

Observable participation equality (OPE) is a group level construct and was measured for each group by calculating the relative participation inequality using I (Hiltz et al. 1989; Reinig and Mejias, 2014), which provides an unbiased estimate of the Gini Coefficient (Dixon et al. 1987). The sign of this Gini Coefficient was then reversed to capture participation equality rather than participation inequality (see Appendix B). We used number of comments as our unit of participation following the methodology of used by Hiltz et al. (1989). Two researchers independently tallied the number of comments submitted by each participant. Inter-rater reliability was adequate (r = .976).

Perceptual participation equality (PPE) is an individual level construct as it reflects the perceptions of each individual group member. PPE was measured via a post-experimental questionnaire completed by each participant. Participants were asked to indicate the extent of their agreement with three previously validated survey items drawn from (Mejias 2007) and (Tyran 1993) using a 7-point Likert scale ranging from strongly agree (1) to strongly disagree (7). (See Appendix A1). These items were then reversed so that higher values captured greater perceptual participation equality. Cronbach's alpha for the three PPE items (α = .784) indicated an adequate level of reliability (Fornell and Larcker 1981; MacKenzie et al. 2011).

Satisfaction with the decision (SD) and S*atisfaction with the process (SP)* are individual level constructs. SD and SP were measured via a post-experimental questionnaire; each used three previously validated survey items from (Green and Taber 1980; Tyran 1993) (see Appendix A1). Cronbach's alphas for the SD items (α = .771) and SP items (α = .754) indicated adequate reliability (MacKenzie et al. 2011).

Consensus change (CC) is a group level construct, that was calculated using Kendall's Coefficient of Concordance which measures the association among multiple rankings of a set of objects (Siegel and Castellan 1988). CC was calculated by the difference in Kendall's Coefficient of Concordance between each of the group's first and second ranking. Thus, a positive CC indicates that members' rankings after the group discussion became more similar (i.e. higher consensus) than they were before the group discussion.

Analytical Procedures

Participants are nested within groups, which means that some data are at the individual level (e.g., PPE, satisfaction with decision, satisfaction with process), and some data are at the group level (e.g., OPE, consensus change). If uncontrolled, this multi-level structure of the data had the potential to bias estimates of the hypothesized relationships between PPE, OPE, and the other variables. To determine whether there was sufficient variance at the group level to require the use of a multi-level method of analysis, we conducted one-way ANOVAs testing for group effects on each of the individual level variables and calculated their intraclass correlation coefficients (ICC1) as recommended in past research (e.g., Klein and Kozlowski, 2000; Bliese, 1998). The ANOVA results indicated the presence of a significant group effect on ratings of PPE ($F_{32,257}$=1.96, p=.003) and the ICC1 was .14, indicating that 14% of the variance in the PPE ratings was attributable to group membership. The ANOVA results also revealed a marginally significant group effect on ratings of satisfaction with the decision ($F_{32,257}$=1.37, p=.101) with an ICC1 of .06. The group effect on satisfaction with the process was non-significant ($F_{32,257}$=.90, p=.633) and the ICC1 was .03. Given that the group effect on PPE was significant, and prior research suggests that ICC1 values as low as .05 are indicative of the presence of important group level effects (LeBreton and Senter, 2008), the findings indicated that a multi-level method of analysis that controls for the hierarchical nature of the data was needed. For this purpose, we selected the "Complex Estimation" procedure in the Mplus software program (Muthén and

Muthén 1998-2012) because it controls for stratification, non-independence of observations due to cluster sampling, and/or unequal probability of selection. This estimation method which is described in Muthén and Satorra (1995) produces maximum likelihood parameter estimates with standard errors and a chi-square test statistic that are robust to non-normality and non-independence of observations.

The PPE, SD, and SP constructs were represented by scale scores in the analysis because sufficient degrees of freedom were not available at the group level to simultaneously estimate all of the hypothesized structural relationships in addition to all of the measurement model parameters using PPE, SD, and SP as latent constructs with multiple indicators. That is, we used a multi-level model (i.e., individuals nested within groups) but used each individual's scale score for PPE, SD, and SP, rather than the underlying items comprising these scales. The primary disadvantage of this approach is that it ignores measurement error. Therefore, to control for measurement error when testing the hypothesized structural relationships (i.e., H2-H6) we used Cronbach's alpha as an estimate of each scale's reliability and fixed its associated measurement error term at (1-α) times the variance of the scale score (cf. Bollen 1989; Jöreskog and Sörbom 1982). This uses the Cronbach's alpha to partition the total variance of each scale score into the proportion attributable to a common source (i.e., the construct being measured) and the proportion due to measurement error.

Finally, two dichotomous dummy variables were used to represent the three treatment levels (CMC-Identified, CMC-Anonymous, and Face-To-Face) in the analysis. For both dummy variables, we used FTF as the reference or control condition (as has been common in prior research). Thus, we created a dummy variable called CMC-I which had the value of 1 for participants in the CMC-I condition and the value of 0 for participants in the other conditions; and another dummy variable called CMC-A which had the value of 1 for participants in the CMC-A condition and the value of 0 for participants in the other conditions. Therefore, the coefficient for the CMC-I dummy variable represents the difference between the mean of the CMC-I condition and the mean of the FTF condition; and the coefficient for the CMC-A dummy variable represents the difference between the mean of the CMC-A condition and the mean of the FTF condition (Cohen, Cohen, West, and Aiken, 2003).

RESULTS

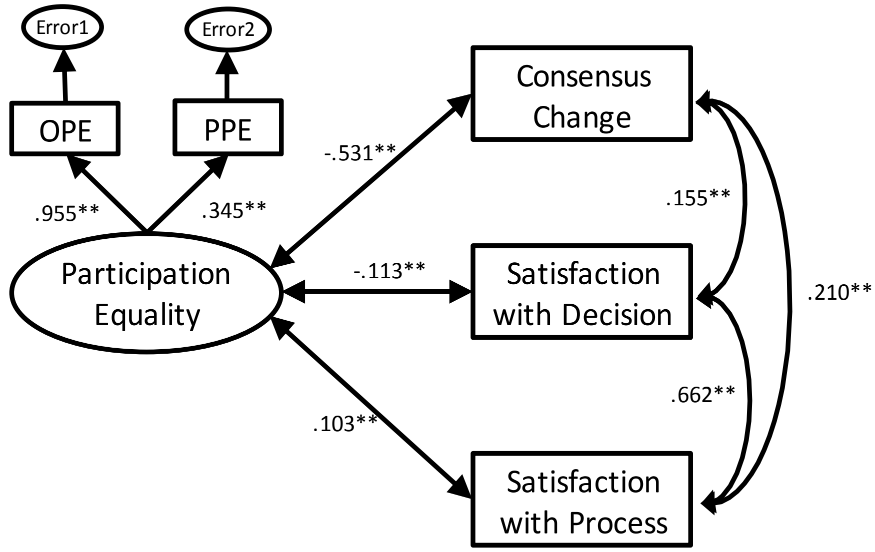
Is Participation Equality One or Two Constructs?

Table 2 provides descriptive statistics for the dependent variables in our study. We first assessed whether OPE and PPE are separate and distinct constructs (H1). We estimated a model with OPE and PPE as reflective indicators of a *single* latent "participation equality" construct (Figure 1A) and then compared the fit of this model to a model where OPE and PPE were treated as *separate* constructs (Figure 1B). Note that the double-headed arrows in these figures indicate correlation, not directional effects.

Table 2. Means and Standard Deviations by Treatment Condition

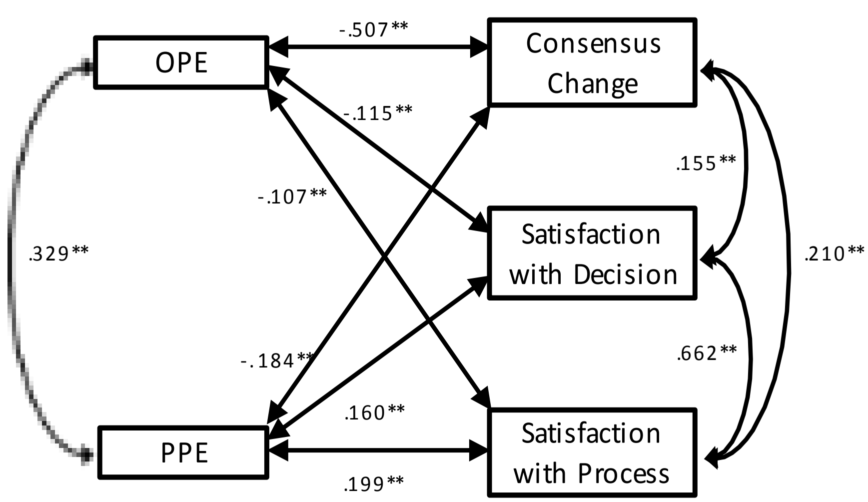
	Face to Face		GSS Identified		GSS Anonymous	
	Mean	**Std**	**Mean**	**Std**	**Mean**	**Std**
Consensus Change (CC)	0.310	0.063	0.136	0.105	0.148	0.134
Satisfaction with Decision (SD)	4.886	1.076	4.705	1.086	4.489	1.238
Satisfaction with Process (SP)	5.423	0.981	5.098	0.983	5.155	1.061
Perceptual Participation Equality (PPE)	3.744	1.191	4.489	1.223	4.530	1.250
Observable Participation Equality (OPE)	-0.382	0.064	-0.230	0.061	-0.158	0.047
SD1	4.927	1.341	4.750	1.400	4.602	1.402
SD2	4.902	1.330	4.909	1.256	4.432	1.603
SD3	4.829	1.205	4.460	1.421	4.432	1.354
SP1	5.293	1.191	5.159	1.144	5.307	1.299
SP2	5.659	1.045	5.386	1.263	5.295	1.252
SP3	5.317	1.121	4.750	1.358	4.864	1.366
PPE1	3.537	1.433	4.250	1.416	4.250	1.541
PPE2	4.085	1.450	4.739	1.450	4.682	1.608
PPE3	3.610	1.438	4.477	1.516	4.659	1.500

The goodness of fit indices indicate that the *single* construct model in Figure 1A did not fit the data. The chi-square statistic was 22.5 which is significant ($\rho < .01$). The Comparative Fit Index (CFI) was .896 and the Tucker-Lewis index (TLI) was .48 both of which are below the recommended level of .95 (cf. Hu and Bentler 1999). The Root Mean Square Error of Approximation (RMSEA) was .20 which is above the recommended level of .05 (Browne and Cudeck 1993; Hu and Bentler 1999) indicating that its associated probability of a close fit was less than .01. Additionally, in the model shown in Figure 1A the item reliability for PPE (as an indicator of the latent construct participation equality) was only .12 (i.e., $.345^2$) which is below the recommended level of .50 (cf. MacKenzie et al. 2011).



Note: All estimates are standardized. * p<.05, ** p<.01, *** p< .001

Figure 1A: OPE and PPE as Indicators of a Single Latent Construct



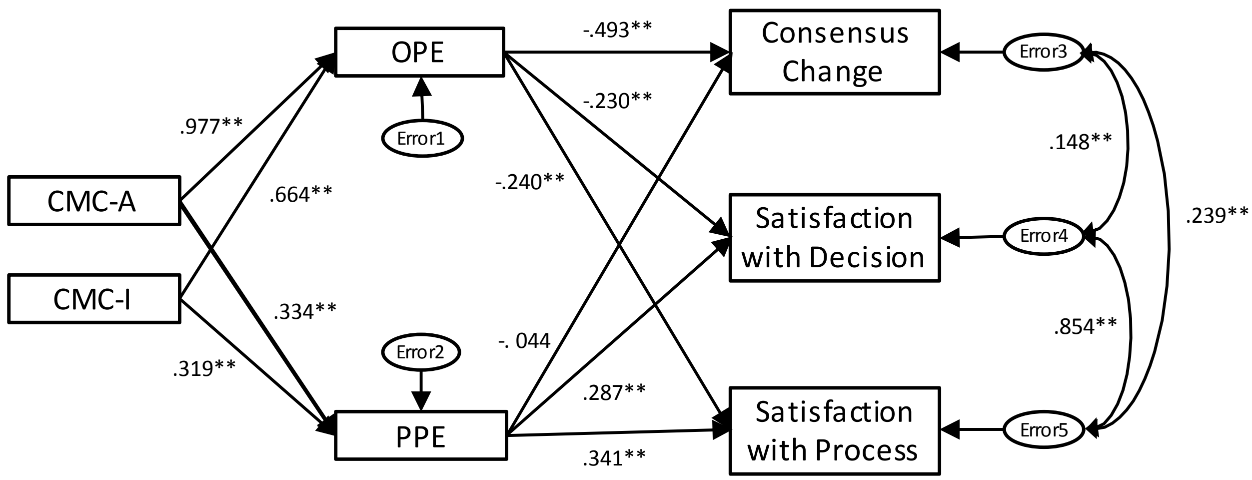
Note: All estimates are standardized. * p<.05, ** p<.01, *** p< .001

Figure 1B: Correlations of OPE and PPE as Separate Constructs

In contrast, the goodness of fit indices for the model in Figure 1B, which treats OPE and PPE as separate constructs, suggest that this model fits the data perfectly (as it must since it is a completely saturated model). We use the Akaike Information Criterion (AIC) to compare the models because it is widely used, can be computed for models with zero degrees of freedom (i.e., saturated or just-identified models like our Figure 1B), and can be used to compare non-nested models (e.g., like Figures 1A and 1B). A comparison of the AIC values suggests that the model in Figure 1B (AIC = 1413.856) provides a better fit than the model in Figure 1A (AIC =1428.592) as its AIC value is smaller (Akaike 1974). In addition, we tested whether the correlation of .329 between OPE and PPE was significantly less than 1.0 using a 90% confidence interval and found that the confidence interval (.186 to .472) did *not* include the value of 1.0 (cf. MacKenzie et al. 2011) . Finally, although OPE and PPE were found to be correlated, the findings indicate that they have surprisingly *little in common*. The degree of overlap between the two constructs is captured by their correlation which was only .329 as shown in Figure 1B. This means that OPE and PPE have only 10.8 percent ($.329^2$) of their variance in common. Certainly, if nearly 89.2 percent ($1 – .329^2$) of the variance in PPE is *not* shared with OPE, the two constructs are far more different than they are similar. Taken together, this pattern of findings provides support for H1, and indicates that OPE and PPE are separate and theoretically distinct constructs.

Antecedents and Effects of PPE and OPE (H2, H3, H4, H5)

Given that the results indicate that OPE and PPE are separate and distinct theoretical constructs, we then examined their antecedents and effects to see if they responded in similar ways and if they had similar effects on outcomes. As previously discussed, we used two dummy variables for the three treatments (FTF was the control condition, so CMC-A compares anonymous CMC to FTF, and CMC-I compares identified CMC to FTF). We controlled for measurement error by fixing the measurement error terms for PPE, SD and SP, at (1-α) times the variance of the scale scores (cf. Jöreskog and Sörbom 1982). As shown by the double-headed correlation arrows in Figure 2, we allowed the structural error terms for CC, SD and SP to covary in order to control for potential relationships among them (cf. Smith et al. 2007; Zellner 1962).



Note: All estimates are standardized. The control condition is Face-to-Face, so CMC-A and CMC-I test the differences from the FTF control condition. * p<.05, ** p<.01, *** p< .001

Figure 2: Test of Hypothesized Antecedents and Consequences of Observable Participation Equality and Perceptual Participation Equality

Overall, the goodness of fit indices suggest that this model fit the data well. The CFI was .963; the RMSEA was .065; the associated probability of a close fit was .257; and the standardized root mean square residual was .049 (cf. Hu and Bentler 1999). Consistent with H2 and H3, the results indicate that anonymous CMC and identified CMC both significantly increased OPE and PPE compared to FTF communication (as shown by the significant positive standardized estimates in Figure 2). Follow-up tests indicated that anonymous CMC ($\beta = .977$, $p < .01$) had a significantly stronger effect on OPE ($t = 3.088$, $\rho < .01$) than identified CMC ($\beta = .644$, $p < .01$) as predicted in H4a. Contrary to H4b there was no significant difference between anonymous CMC ($\beta = .344$) and identified CMC ($\beta = .314$) in effects on PPE ($t = 0.15$, $\rho > .10$).

Contrary to H5a, PPE was not significantly associated with consensus change ($\beta = -.044$, $\rho > .10$). However, higher PPE was associated with significantly higher satisfaction with the decision ($\beta = .287$, $\rho < .01$) and higher satisfaction with the process ($\beta = .341$, $\rho < .01$) as predicted by H5b, and H5c. Consistent with H6a, H6b, and H6c, higher OPE was significantly associated with lower consensus change ($\beta = -.493$, $\rho < .01$), lower satisfaction with the decision ($\beta = -.230$, $\rho < .01$), and lower satisfaction with the process ($\beta = -.240$, $\rho < .01$). In addition, we found that the combined effects of OPE and PPE accounted for approximately

26% of the variance in consensus change: 10% of the variance in satisfaction with the decision, and 10% of the variance in satisfaction with the process.

Thus OPE and PPE influenced decision satisfaction and process satisfaction, but in opposite ways as expected. Higher OPE was associated with lower decision satisfaction and lower process satisfaction, while higher PPE was associated with higher decision satisfaction and higher process satisfaction. OPE and PPE are present simultaneously in all group interactions; when group members interact, each participant forms his or her own perceptions about the participation behavior that took place in the group process. Our analysis controls for the effects of OPE when estimating the effects of PPE (and vice versa), indicating that the opposing effects of OPE and PPE on decision satisfaction and process satisfaction are quite provocative and may explain some of the inconsistencies in prior research findings regarding participation equality.

DISCUSSION

The results from our study support our arguments that observable participation equality (OPE) and perceptual participation equality (PPE) are separate and theoretically distinct constructs. A two construct model produced a better fit for the data than a one construct model. The shared variance between OPE and PPE was relatively low (r^2=10.8%), suggesting that the two constructs are more different than they are similar. OPE and PPE also generated different relationships with the independent and dependent constructs in the nomological network of group work. As separate and distinct constructs, OPE and PPE reacted in different ways to different manipulations of CMC, and produced *opposite* effects on consensus change, satisfaction with the decision, and satisfaction with the process.

Previous research has often seemingly viewed OPE and PPE as interchangeable interpretations of the same underlying construct. However. our results demonstrate conditions in which they behave quite differently. Our results indicate that observed participation equality and perceived participation equality are separate and theoretically distinct constructs and are not alternative operationalizations of a single participation equality construct. Therefore, we conclude that much of the inconsistency in past research may be attributed to the use of OPE and PPE to measure the same fundamental, theoretical construct called participation equality. We recommend that future research use the more precise terms of OPE or PPE when conceptualizing and measuring "participation equality as the construct(s) of interest.

OPE is an "objective" or empirical view of participation equality in that it measures how participants actually behaved. In contrast, PPE is a "subjective" or perceptual view of participation equality in that it measures what participants believe about their own relative level of participation. Neither construct should be claimed as being more or less "correct"; they simply represent different operationalizations from which to assess participation. The modest correlation between PPE and OPE ($r = .329$) illustrates the tenuous link between OPE and PPE in that *perceptions* of participation equality may not be accurate representations of *observable* participation equality. Conversely, empirical observations of participation equality are not accurate representations of what participants perceive. Because PPE and OPE share only 10.8% of their variance, nearly 90% of the variance in PPE is due to factors other than observable behavior.

As OPE and PPE are present simultaneously in virtual and FTF group discussion processes, (i.e., behavior occurs and participants form perceptions of it), it is important to consider their combined effects, rather than focusing on one construct or the other. Taken together (see Figure 2), we see that higher OPE is associated with negative effects on group decision outcomes (i.e., lower consensus, and lower decision and process satisfaction). In contrast, higher PPE is associated with positive effects on other outcomes (i.e., higher decision and process satisfaction).

Past research and theory has often presumed that more equal participation is desirable and leads to better group decision outcomes. Our results suggest differently. While higher PPE was associated with greater satisfaction, OPE, which was in fact more equal, was associated with lower consensus and lower satisfaction. Most groups strive for high consensus and high satisfaction, so this presents a bit of a quandary.

With apologies to Orwell (1945), we conclude that the most successful groups, with regard to consensus and satisfaction, appear to be those in which group members perceive that they participated equally, while in reality some group members participated more equally than others.

At first these results seem contradictory, but we believe that they may be explained by an individual's *desire* to participate. Some individuals may want to participate more while others may want to participate less (Straus 1997). The PPE construct may reflect an individual's perceived *opportunity* to participate at their own desired level of participation, as opposed to whether their actual participation was equal with others. For example, individuals who prefer to participate less actively in a group process and thus, participate less than others, may nonetheless perceive that they participated as equally as other members. From their viewpoint, it would not be reasonable to expect them to have participated more.

Anonymous CMC had a stronger effect on OPE than identified CMC (β = .977 vs. β = .664 in Figure 2), but there were no significant differences between anonymous CMC and identified CMC for PPE (β = .334 vs. β = .319). Thus, while anonymity has been considered to be important in influencing *behavior*, it had no effect on *perceptions*. Anonymity is often viewed as a shield in environments where status or power differences exist among participants, particularly when the task is contentious or where future interactions with group members are important (Haines, et al., 2014; Nunamaker et al. 1991; Raines and Scott, 2007). Our study was a one-time experiment with randomly assigned undergraduate students who were peers completing a low-threat task with little chance for future interactions. Yet our results indicate that anonymity still had a significant impact on OPE.

What do these findings suggest for participation as technologies for virtual groups expand to include new CMC modalities, such as WC, VR and ESM (Durr, et al., 2016; Leonardi, et al. 2013; Stewart and Shamdasani, 2017; Wang, et al., 2014)? WC for virtual groups is the latest incarnation of CMC technology which has been studied and used in organizations since the 1980s under a myriad of different labels (e.g., Group Decision Support Systems, Group Support Systems, Groupware, Collaboration Technology). While user interfaces (mouse and windows with integrated video and audio), global reach (the WWW and the Internet) and application mechanisms (Web browsers) have evolved over the years, the fundamental affordances of the decision making process have changed relatively little (cf. DeSanctis and Gallupe, 1987; Nunamaker, et al. 1991) because the collaborative needs of groups haven't changed much over the decades.

VR offers a few enhancements from traditional CMC technologies because video interaction is provided via avatars and not directly through a camera. In VR environments, gestures require an explicit and deliberate action on the part of a user as distinct from video (or FTF). We believe that many of our research findings regarding participation and participation equality may also apply to virtual groups working in WC and VR environments because of their similarities to prior CMC technologies. But there are also some new considerations. For example, when we examine OPE in VR, should we consider gestures as a form of participation because participants may now require a conscious reaction?

ESM tools may differ most from current group technologies as they are designed to support interaction for larger groups that typically share common interests, but whose members may not be working together on a common task (Leonardi, et al. 2013). For such large groups, do we really want many, most, or all group members to participate in such environments? Preece and Shneiderman (2009) argue that participation in ESM can be conceptualized using a reader-to-leader model, in which participation begins by reading content, then moves to participating occasionally, then collaborating with others routinely, and finally to participation in leading and synthesizing discussions. A study of 8,711 ESM communities at IBM reported that 90% of the 225,000 participants submitted *no* comments (Muller, 2012). Similar low participation rates have been reported by other organizations using ESM (e.g., Brzozowski, Sandholm, and Hogg, 2009).

Traditionally, reading (or "lurking") has not been considered to be participation within small group settings, because social norms create an expectation to contribute. ESM social norms are different and do not create this same pressure to contribute. Preece and Shneiderman (2009) argue that different factors influence reading, contributing, collaborating, and leading in ESM. Nonetheless, participation beyond lurking is an important determinant of success in the use of ESM environments (Durr, et al. 2016). The most important factor influencing actual participation (OPE) in ESM environments is the size of the group (Warshaw, et al., 2016). When ESM communities resemble virtual groups in size (i.e., 3-12 members), participation and OPE begin to resemble the patterns commonly seen in virtual group research (Warshaw, et al., 2016). Thus, the goals and norms of the group, rather than the technology used (e.g., CMC-A, ESM) influences participation. As large ESM communities have different goals and norms than smaller virtual groups (Warshaw, et al., 2016), they generate different participation behaviors.

We speculate that our findings about OPE and PPE may apply to newer technologies such as ESM when they are used to support small groups. It is plausible that differences in OPE and PPE may also apply to larger communities where the vast majority of participants contribute nothing beyond reading. Here, OPE is clearly unequal, yet PPE may not show such striking differences because participants perceive an equal opportunity to contribute or participate.

The studies of ESM cited above have retained the traditional definition of participation as the contributed text. What transpires if we move beyond this traditional definition of participation as remarks, comments, utterances, or words to other forms of active participation (i.e., not reading or lurking) to include “like,” “love,” “angry,” and the myriad of other icons used to express an opinion? Should submitting an imoge be assessed as “participation” to the same extent as composing and contribute text? As we move into new CMC technologies that enable new forms of participation, we need to consider what constitutes "participation" and how new forms of participation should be measured and evaluated.

Once again, we believe that the distinction between OPE and PPE will continue to remain important. Clearly, while it takes more effort to contribute a text than to submit an imoge, should more participation “credit” be given to a contributed text? Is this difference important in the mind of a group member who assesses their perception of participation? Is “liking” a particular post less participative than contributing a comment? As new CMC technologies continue to challenge our definitions of participation, we believe OPE and PPE may diverge even more. Overt external indicators of OPE may reveal a significantly different story than the internally focused metrics of PPE. For the large group environments of ESM, moving away from “participation equality” to research questions and methods clearly focused on OPE and/or PPE is critical.

Limitations

This study suffers from the usual limitations of experimental research. We studied *ad hoc* groups of undergraduate students who worked for a brief period of time on a task in which they had no vested interest. It is important to understand that we never generalize from the specific behavior observed in the laboratory to specific behavior in the field (Lee and Baskerville 2003). Instead, we first generalize from theory to behavior in the laboratory and then from the results in the laboratory back to theory. Secondly, we generalize from the theory to behavior in field settings (i.e., we analyze if this theory applies to these individuals within this specific organization, working on this specific task) (Lee and Baskerville 2003). We never argue that a specific laboratory setting matches or is generalizable to a specific field setting (Lee and Baskerville 2003). Indeed, most field settings are not identical to other field settings. Our experiment therefore focuses only on the first component of theorizing: an initial test of a theory in an experimental setting. Thus, the first important question is whether a laboratory setting is an appropriate venue for testing our theory about participation equality (Lee and Baskerville 2003). We believe that this theory applies to the experimental groups in our research setting. As our empirical findings indicate, we conclude that a controlled laboratory experiment was an appropriate setting for testing for the association of *observable* participation equality with *perceptual* participation equality.

The second important question is to what extent does our theoretical framework apply to groups working in field settings? That is, what are the boundary conditions and limitations of the theory? Specific measures of OPE and PPE may produce similar or different results depending upon the specific group, task, technology and context. The relationships between OPE and PPE and the constructs within the nomological network that we tested (e.g., anonymous versus identified CMC; consensus, decision satisfaction and process satisfaction outcomes) may also depend upon the specific group, task, technology and context. For example, anonymity may have little effect when evaluation apprehension is low (Nunamaker et al. 1991).

Implications for Research

Despite these limitations, we believe our findings offer five implications for future research. First, our results show that OPE and PPE are separate and theoretically distinct constructs. Future research needs to distinguish between OPE and PPE in theory and measurement to ensure that the appropriate measurement of participation equality follows from the theoretical construct of interest. This misalignment in theory and measurement may account for some of the inconsistencies in prior CMC research. We also conclude that we should exercise caution when referring to "participation equality," by more precisely identifying observed participation equality (OPE) or perceived participation equality (PPE) as the construct of interest. Our results suggest that it may be appropriate to use both OPE and PPE as they interact in unique ways with other constructs in the nomological network of group decision work.

Second, we believe that these results call for more theoretical and empirical research on the differences between OPE and PPE as they are separate and theoretically distinct constructs that are more different than they are similar. OPE and PPE interact in different and sometimes opposite ways within the nomological network of group decision-making. OPE had only a small and relatively unimportant association with PPE. Therefore, we need to develop a better understanding of the theoretical foundations that influence perceptions of participation and how OPE and PPE interact to influence outcomes and decisions.

Third, we studied OPE and PPE in the context of groups working synchronously on a mixed motive task that had no correct solution. What are the implications for the use of other CMC technologies that are not synchronous, such as discussion forums, wikis, blogs, and other social media networks? Would such variations result in unequal observed or perceived participation equality? Is PPE "more equal" than OPE in virtual environments? Our experiment used anonymous pen names to provide some conversational coherence without explicitly identifying the author (Rains and Scott, 2007). Blogs enable the use of real names or pen names, but other group technologies such as wikis commonly do not. What are the effects of anonymity on observed or perceived participation equality for these newer technologies? Does anonymity induce less equal OPE but similar PPE as it did with the experimental groups in our study? We encourage more research on OPE and PPE in asynchronous and anonymous CMC decision making.

Fourth, new CMC technologies such as VR or ESM may alter our conceptualization of participation and participation equality. Should we consider making a gesture, reading a post, or submitting a “like” button or imoge as “participation” in the same way as we consider speaking or submitting a comment? Within these new technological environments, the differences between OPE and PPE may continue to become more pronounced. Thus we encourage researchers to be clear in identifying their theoretical construct of interest; whether it may be overt behavior or perceptions of behavior and to use the appropriate measure of that construct of interest. Initial research with newer technologies such as ESM suggests that participation may not be changed by technology but rather that participation may be affected by the group size, goals and norms. Nonetheless, we advocate more research on PPE and OPE in ESM and other new CMC technologies.

Finally, at a more general level our results indicate that *perceptions* of behavior did not match *observations* of behavior. Our research focused on the observed *amount* of a particular behavior (e.g., participation equality). What are the implications of this finding for other constructs? Are *perceptions* of the use of a particular technology and the *observable use* of that technology different for other technologies (e.g., office productivity software, enterprise wide systems, mobile devices, etc.(Burton-Jones and Straub 2006)? Are there also differences between observations and perceptions with regard to the *content* of a particular behavior in other group decision settings? For example, is there a difference between the observable and perceptual emotional tone in how participants interact within CMC environments (e.g., Piccoli and Ott 2014)? We believe our results call for more theoretical and empirical research exploring the differences between observable and perceptual behaviors in decision making environments.

Implications for Practice

Our focus in this paper is primarily on research. Nonetheless, we believe our results also have implications for practice. Taken at face value, our findings appear to be paradoxical. That is, consensus and satisfaction are the highest when group members *perceive* that participation has been equal, when in fact, actual *observable* participation has been unequal. Hence, our recommendation is that all group members should participate equally, but some should participate *more equally* than others. If the goal of CMC is to ensure that group members reach consensus and are satisfied with the decision and processes of their work, it is important that individual group members *perceive* they had the opportunity to participate equally, when in reality they did not strive for perfectly equal participation., That is, truly *observable* equal participation behavior could be counterproductive and lead to lower consensus and satisfaction.

Thus, a delicate balance exists when using CMC for group decision making. Group members must perceive the opportunity for equal participation while at the same time not insist that everyone would actually participate equally. It is about creating opportunities for participation and not about forcing group members to participate at some arbitrary level of perfect equality. An analogy would be an open door policy in which a supervisor invites subordinates to drop by as needed, all the while acknowledging that if too many subordinates actually do, that it may take time away from other important activities (Beck and Beck 1987; Detert and Burns 2001; Toren 2015). Creating an open door policy for equal participation in decision making, but not requiring people to actually use it may best illustrate the balance of perceptions of behavior against actual observable behavior.

CONCLUSION

Past research has generated inconclusive and inconsistent results regarding the participation equality construct and its effects on various CMC decision outcomes. Our research shows that observable participation equality (OPE) and perceptual participation equality (PPE) are separate and theoretically distinct constructs that are more different than they are the same, sharing only 10.8% of their variance in common. PPE and OPE affect and are affected by, other constructs in different ways within their nomological network of group decision work. We believe this recognition and distinction is an important first step in generating a better theoretical understanding of participation equality and in producing more consistent empirical research results. We hope our results encourage more research regarding the differences between observable behavior and perceptions of that behavior in traditional CMC technologies used for group decision making, as well as newer collaborative technologies such as WC, VR, and ESM.

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