

Critical thoughts about critical mass in representative bureaucracy: A theoretical exploration and empirical illustration

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Abstract

Studies of representative bureaucracy frequently reference the need for a critical mass before an underrepresented group can influence policy outputs or outcomes, but the empirical literature is modest and presents mixed findings. This article presents a theoretical exploration to illustrate how critical mass can link individual behavior to organizational contexts. By examining both active representation and symbolic representation at both the individual and organizational level and specifying the different microprocesses of active representation, a series of testable hypotheses are presented. The logic suggests that the concept of critical mass might also be a useful contextual variable to examine other aspects of administrative behavior. Based on the theory, two empirical illustrations from China are presented.

Both administrative behavior within an organization and client responses to the organization operate in institutional contexts that sanction some behaviors and restrict others (Simon, 1947). Representative bureaucracy poses an interesting case of administrative behavior because representation can be contrary to the primary goal of the organization (Meier, 2019). As a result, active representation by bureaucrats and perhaps symbolic representation actions by clients are subject to a variety of contingencies imposed by the organization or limited by the environment

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(most commonly salience and discretion; see (Gilad & Alon-Barkat, 2018; Keiser et al., 2002; Riccucci & Van Ryzin, 2017). One interesting contextual factor theoretically is the concept of a critical mass whereby a bureaucrat is more likely to engage in representation if a critical mass of bureaucrats shares the represented identity. The concept of a critical mass links individual behaviors to the organization and recognizes the interplay between individual and organization to shape behaviors. The potential linkage implies that a theoretical exploration of the concept critical mass in representative bureaucracy might also be relevant to other organizational behaviors.

This essay specifies a micro-theory linking a critical mass of bureaucrats to outcomes predicted by the theory of representative bureaucracy. By addressing how both aggregate and individual level studies of active and symbolic representation could be affected by a critical mass of bureaucrats, it attempts to bring some clarity and precision to an existing literature with mixed findings. Specific hypothesis applied to three processes—decisions by individual bureaucrats, policy change by the organization, and contagion effects by nonrepresentative bureaucrats—outline a research agenda on critical mass and representative bureaucracy.

1 | CRITICAL MASS IN THE REPRESENTATIVE BUREAUCRACY LITERATURE

Studies of representative bureaucracy link passive representation (the social identities of bureaucrats) to outcomes that benefit the represented clients through either active representation (by the bureaucrat) or symbolic representation (through changes in client behavior or attitudes). In addition to the demographic matchup of bureaucrats and clients, such outcomes are affected by the salience of the identity, the link between identities and policy outcomes, and bureaucratic discretion (Eckhard, 2021; Keiser et al., 2002; Riccucci and Van Ryzin, 2016; Wilkins & Keiser, 2004). One stream of research using the concept of critical mass (Kanter, 1977a) examines how representation might exist only after a social group attains a minimum level of representation. The hypothesis is that until an under-represented group attains a critical mass (research frequently uses 15% as attributed to Kanter¹), passive representation would not generate positive benefits for the represented group. In particular, bureaucrats would be unwilling to represent by actively advocating the interests of clientele until a substantial number of bureaucrats with the same identity could provide support for such actions. The empirical literature, however, is mixed: it appears to vary across substantive areas (Atkins & Wilkins, 2013; Selden, 1997), at different levels of the hierarchy (Andrews et al., 2014; Meier, 1993), or not be needed at all (Schuck, 2018). These mixed findings suggest weaknesses in existing theory such that additional theorizing is needed to clarify when and why a critical mass might be needed.

Passive representation could benefit represented clients in various ways. First, active representation—bureaucrats seeking to benefit clients who share their identity—can occur when bureaucrats (1) make individual decisions, (2) attempt to change organizational policies, and (3) influence the behavior of other bureaucrats. Second, symbolic representation can lead minority clients to change their behavior or attitudes in response to bureaucrats who share demographic characteristics. This article posits that whether a critical mass is necessary differs in each of these processes and presents a set of falsifiable hypotheses.

Although the notion of a critical mass in representative bureaucracy has only been applied at the aggregate organization level (Atkins & Wilkins, 2013; Meier, 1993; Nicholson-Crotty et al., 2017) and appears to be an aggregate or collective level concept, the idea has clear implications for individual behavior (see Kanter, 1977a). A full theory of critical mass in representative

bureaucracy as a result, needs to address how a critical mass might affect either active or symbolic representation either in terms of individual behavior or aggregate behavior. By examining the various combinations, our hypotheses suggest that a critical mass can have different impacts for different processes of representation within a single organization.

2 | EXPLORING CRITICAL MASS

2.1 | Kanter's work on critical mass

Kanter (1977a) first used the concept of critical mass to explore the idea of “token women,” the case when women constituted small numbers in an organization, but their behaviors were to represent all women. Kanter (1977a, 1977b) theorized that as the percentage of women in an organization increased that it would affect the behavior of both the women in the organization and how men reacted to their presence. These changes in behavior in turn affect the organization as a whole as the gender distributions reach certain thresholds.

Why might Kanter's notion of a critical mass apply to the theory of representative bureaucracy? The reasoning differs depending on whether one is concerned with active or symbolic representation (see Gilad & Alon-Barkat, 2018; Riccucci and Van Ryzin, 2016). In terms of active representation, to the degree that the bureaucrat can act autonomously or independently, the presence of other representative bureaucrats would be irrelevant. The need for a critical mass, therefore, is only pertinent when actions of the bureaucrat are subject to review, approval, or some type of audit by others in the organization. Factors that influence the need for a critical mass, as result, might include traditional core variables in representative bureaucracy such as discretion and salience as well as factors that contribute to autonomy such as professionalization, hierarchy, transparency, organization socialization, and deviation from standard operating procedures.

Symbolic representation, in contrast, occurs when clients react to a bureaucrat or bureaucrats who looks like them and changes either attitudes (acceptance, legitimacy) or behaviors (cooperation, coproduction) or both. The first step in symbolic representation is to notice the representative bureaucrats which implies a positive correlation between symbolic representation and the proportion of representative bureaucrats and, thus, a critical mass. The need for a critical mass might increase to the extent that the bureaucratic representatives are not visible to the client or that some other factor interferes with the symbolic representation process (Headley et al., 2021; Murdoch et al., 2022 and see below).²

3 | CURRENT LITERATURE ON CRITICAL MASS IN REPRESENTATIVE BUREAUCRACY

Although many studies of representative bureaucracy reference the concept of critical mass, few systematic analyses exist. Essays by Thompson (1976), Henderson (1978), and Hinderer and Young (1998) lay out theoretical arguments on critical mass relative to representative bureaucracy. The first systematic effort to empirically examine critical mass in representative bureaucracy (Meier, 1993) found that a critical mass of 16%–26% Latino school principals was needed to affect Latino students on outcomes such as assignments to gifted classes, corporal punishment,

out-of-school suspensions, and expulsions. No critical mass was needed for teachers to affect these same outcomes.

Other empirical literature on critical mass produced different findings. First, what constitutes a critical mass varies among these studies. Atkins and Wilkins (2013) found that a critical mass of 20% Black teachers was necessary to reduce the Black teen pregnancy rates, but Atkins et al. (2014) showed that 40% Latino teachers were needed for Latino students' college expectations to increase (see also Grissom et al., 2017). Second, the findings on critical mass differ at the street level and managerial level. Andrews et al. (2014) do not find critical mass effects at upper-managerial levels. For street-level representation, some studies show the need for a critical mass (Atkins & Wilkins, 2013; Grissom et al., 2017; Keiser et al., 2002), but many others find no critical mass is necessary (Meier, 1993; Meier & Rutherford, 2017). These differences imply that the need for a critical mass might vary at different levels of the organization and in some cases not be needed at all (see Andrews & Miller, 2013; Fernandez, Samuel, and Lee, 2018).

Comparing findings on critical mass is complicated by the three different statistical approaches to examine and locate the level of critical mass. First, some studies use non-linear regression analysis and include the squared term of representation in the equations (Andrews et al., 2014; Andrews & Miller, 2013; Atkins et al., 2014; Fernandez, Samuel and Lee, 2018; Meier, 1993) and then take the first derivative of the equation to estimate the turning point (the inflection point in the curve). Second, other studies separate organizations into high representation and low representation groups (Keiser et al., 2002; Nicholson-Crotty et al., 2011) and estimate representation in both groups expecting the representation to appear only in the high representation group.³ Third, some studies include a set of dummy variables representing different levels of representation in the same equation as the way to determine the level of critical mass (Atkins & Wilkins, 2013; Grissom et al., 2017). Differences in results could be from differences in methods (Meier, 2019, pp. 48–49).

In sum, research on critical mass in representative bureaucracy has shown mixed results. The critical mass threshold appears to differ among the existing studies and often finds null results. Those mixed findings could occur for several reasons. Although most studies examine these questions with aggregate data, others (Guul, 2018; Nicholson-Crotty et al., 2011; Vinopal, 2018; Xu & Meier, 2021) focus on individual behavior and a one-to-one match of bureaucrats and clients. The studies also do not distinguish between active and symbolic representation even though these are very different processes that affect different individuals. Finally, the micro-theory of exactly how representation occurs particularly for active representation is not specified, and some impacts such as a policy change by the organization might be more reliant on a critical mass than others.

4 | CRITICAL MASS AND TYPES OF REPRESENTATION AND LEVELS OF ANALYSIS

The following sections trace out the microprocesses of representative bureaucracy for both active representation and symbolic representation noting in the process that the empirical choice to study representation at the individual level or the aggregate level can be related to a theoretical distinction between individual representation and collective representation (Favero and Molina 2018).⁴ Within the assessments of active representation, the discussion will also probe whether the representation occurs by the actions of representative bureaucrats, through policy change by the entire organization, or by contagion effects by nonrepresentative bureaucrats. Each section will present specific hypotheses that are linked to specific forms of representation

and their underlying micro-theory. The logic and hypotheses should be interpreted as *ceteris paribus* statements that assume all other things are equal; the individual sections will also note other factors such as hierarchy and professionalism that might not always be equal.

5 | ACTIVE REPRESENTATION AT THE INDIVIDUAL LEVEL

Active representation by bureaucrats to seek outcomes that benefit individual clients who share the bureaucrats' identity, can occur in three ways—by making decisions that seek to benefit the client, by attempting to change organizational policies to benefit a set of clients, and by contagion effects whereby the presence of representative bureaucrats changes the behavior of nonrepresentative bureaucrats. The individual level studies of bureaucrats focus on the decision process and generally omit discussion of policy change or contagion effects (Guul, 2018; Nicholson-Crotty et al., 2016; Vinopal, 2018). While this means that individual level studies will likely underestimate the total impact of a representative bureaucracy, the other two processes can also be studied as individual representation and will be discussed in this section.

5.1 | Individual decisions by representative bureaucrats

Whether a critical mass is necessary for a bureaucrat to actively represent by making a specific decision in regard to a client clearly depends on the organizational context. If a bureaucrat has discretion and the decision falls within that zone of discretion, no critical mass is necessary. A police officer, for example, has full discretion in whether or not to stop a motorist for a minor traffic violation (e.g., failure to use a turn signal). Such decisions are part of the normal discretionary actions of the bureaucrat and are often not visible to others. Prominent examples in the empirical literature where no critical mass is necessary are the impact of minority teachers on grouping, tracking, and student test scores (Meier, 1993) or decisions on child support enforcement at the supervisory level (Wilkins & Keiser, 2006).

Not all individual decisions in regard to clientele fall within a bureaucrat's normal zone of discretion and, thus, could be subject to a critical mass of similar bureaucrats. If the decision to represent falls outside of the normal operating procedures (see Atkins & Wilkins, 2013) or results in outcomes that the organization discourages, the act of representation involves some risk to the bureaucrat (Kanter, 1977b; Meier, 2019). In other cases, the action might be within bureaucratic discretion but allocates more resources than the agency desires as in when the bureaucrat spends too much time with one case (perhaps to the neglect of the others, see Guul, 2018) or allows access to a program where the prospects of success are not good (college prep classes (Keiser et al., 2002)). Meier (2019) presents a set of hypotheses concerning the conditions when a bureaucrat might be willing to take additional risks to represent including slack resources, job security, client need, intersectional match ups (Fay et al., 2021), coproduction (Ricucci et al., 2016), etc. A critical mass might matter for the individual bureaucrat in these cases because a set of bureaucrats making similar decisions signals the bureaucrat that the organization will tolerate these deviations or that the bureaucrat will have the support of colleagues if there are consequences.

H1 *Active representation at the individual level within a normal zone of discretion is not influenced by a critical mass of bureaucrats.*

H1a *At the individual level, a critical mass is more important if the decision is inconsistent with the goals, norms, and processes of the organization.*

H1b *At the individual level, the importance of a critical mass is a function of the potential costs and benefits to the bureaucrat.*

H1c *At the individual level, the critical mass threshold increases as the deviation from organizational goals, norms, and procedures increases, and as the relative costs to benefits to the bureaucrat increase.*

The idea of a zone of discretion implies that other factors that increase bureaucratic discretion such as professionalism, hierarchy, technical expertise, socialization, etc. would also influence whether or not a critical mass is important.

Perhaps one reason that critical mass has not been examined empirically with individual representation is that statistically it requires mixing levels of analysis, and the appropriate level of aggregation is unclear. One appropriate estimation would interact the bureaucrat-client match-up (the individual level) with whether or not the demographic identity attained a critical mass in the organization or the work group (the aggregate level).⁵ A change in slope of the marginal effects' curve would indicate a critical mass.

5.2 | Policy change

Representation via policy change at the individual level should be similar to its assessment at the aggregate level since the entire organization needs to change to enhance representation.⁶ The results of policy change, therefore, will be discussed in the active-aggregate section. Testing for policy change at the individual level is more difficult and requires a measure of representation (e.g., Selden's 1997 "role of the representative") different from a measure of outputs or outcomes (in case the representation is not successful), but this could be done with appropriate data similar to assessing partisan representation effects in the legislatures (Childs & Krook, 2008).

5.3 | Contagion effects: Representation by other bureaucrats

Active representation via contagion effects implies that other bureaucrats will change their behavior as the result of representative bureaucrats in the organization. Theoretically, contagion effects occur because contact between different types of bureaucrats reduces stereotypes and facilitates communication and the exchange of ideas as noted in both the diversity management literature (Groeneveld and Meier, 2022) and the contact thesis in psychology (Amik, 1969). Some studies verify that nonminority bureaucrats can also adopt the role of minority representative (Selden, 1997). If contagion effects exist, in fact, current research at the individual level underestimates representation effects. The common individual level assessment with gender, for example, involves examining outputs for female clients served by female bureaucrats compared to the outcomes for female clients with male bureaucrats (see Guul, 2018; Xu & Meier, 2021). In this case, if male bureaucrats represent as the result of contagion effects, the difference between male and female bureaucrats relative to female client outcomes is reduced. Given this potential threat to validity, incorporating contagion effects is important for a full view of representative bureaucracy.

H2 *Estimates of representative bureaucracy at the individual level underestimate the extent of active representation if contagion effects exist.*

Contagion effects can be studied similar to how one would link critical mass to decisions of individual representative bureaucrats. Rather than examining representative bureaucrats, one should examine the decisions of other bureaucrats who interact with minority clients and determine if their decisions become more favorable to minority clients as the percentage of minority bureaucrats in the organization increases. Applying the contact thesis in psychology to organizations, this suggests that as the proportion of minority group employees increases that the attitudes and behaviors of other bureaucrats will change. Because the likelihood of contact increases with the number of representative bureaucrats, the notion of a critical mass is directly applicable.

H2a *If contagion effects exist, majority bureaucrats will make decisions more favorable to minority clients as the percentage of minority bureaucrats in the organization increases.*

All that is required for H2 to be transformed into a critical mass hypothesis is to estimate how contagion effects increase relative to the increase in representative bureaucrats.

5.4 | Active representation at the collective level

Active representation processes at the collective level parallel those at the individual level, that is, by making decisions that seek to benefit clients, by trying to change organizational policies to benefit clients, and by influencing the behavior of other bureaucrats. Aggregate studies of representation are not generally able to distinguish among these three different processes since the method of analysis is to correlate organizational level demographic identities with organizational level outputs or outcomes.

5.5 | Individual decisions by representative bureaucrats

At the organizational level, the first process by making decisions that seek to benefit the clients is simply the aggregation of individual actions and thus was covered under the section on active representation at the individual level.⁷ Hypotheses 1, 1a, 1b, and 1c should apply. The only difference is that representation is measured as the percentage of representative bureaucrats rather than whether a bureaucrat shares a specific identity; the critical mass estimates and interactions remain the same.

5.6 | Policy change

The most direct application of the concept of critical mass at the aggregate level is the case of representation through policy change. Policy change requires acceptance by the organization either via direct decision by individuals who set policy (e.g., changes in school disciplinary policies, see Roch et al., 2010) or gradual acceptance by street-level implementors (foreign language fluency and policing, see Calderon, 2018). This situation parallels the predominant use of critical mass in the political science literature for legislatures when minority groups need to be part of the governing coalition or a key veto point to have influence (Childs & Krook, 2008). Minority

groups are not likely to be able to change policies until their numbers are sufficient to place the issue on the organization's agenda and demonstrate support for change. As some critical mass is achieved, the prospects of change would improve. A priori there is no way to determine what this critical mass might be since organizations are not democracies and policy decisions are not decided by majority vote (but see Hinderer & Young, 1998).

H3 *If active representation occurs via policy change, a critical mass is necessary. The exact critical mass needed will vary by how the organization makes policy decisions.*

Although representative bureaucracy literature has not addressed the factors that might increase or decrease the critical mass needed, some political science literature on legislatures provides a starting point. Dahlerup (2006) argues that the critical mass for women in legislators is lower in multiparty systems because women have more opportunities to be crucial to a winning coalition when there are cross cutting issues. Applying this logic to bureaucracies, a critical mass might be lower when multiple sets of identities are represented and therefore there are multiple potential sets of allies. The critical mass should also be lower if the representative bureaucrats are positioned at higher levels in the organization (the bureaucratic equivalent of key committee chairs or legislative leaders). The degree of policy change is also likely to be important with larger changes or changes that alter standard operating procedures requiring a larger critical mass.⁸ The salience of the minority identity should lower the critical mass because it presents a more cohesive position on the issue by minority bureaucrats and makes it more likely that other bureaucrats are aware of the policy issue. Pressures from outside the organization could also be a factor since organizations need to pay attention to their reputations both among political elites and the general public (Carpenter & Krause, 2012). Organizations with negative reputations on issues of equal treatment are likely to generate greater challenges from other political institutions and face issues of trust and cooperation from the general public. These factors all suggest a qualification to the third hypothesis:

H3a *The critical mass for policy change in a bureaucracy will be lower if the organization contains multiple strong identities, minorities are at higher levels in the organization, the change is modest in terms of policy or procedures, the key identity is highly salient, or there is support for change in the organization's environment.*

5.7 | Contagion effects

The third collective process, contagion effects, is likely to be affected by a critical mass. As noted above, the contact thesis assumes that as the number of minority bureaucrats increases, contact between majority and minority bureaucrats increases. This greater contact provides the opportunities to share insights, learn about interacting with different types of clients, and other actions that might result in representation.

H4 *A critical mass of minority bureaucrats is necessary for passive representation to change decisions by other bureaucrats.*

Because aggregate contagion effects are dependent on the interactions among majority and minority bureaucrats, the size of the critical mass should vary based on factors within the organization. Minority bureaucrats might have little impact on other bureaucrats if the organization is segregated (by hierarchy, area, or occupation) and contact across groups is limited. A recent

article merging the literature on representative bureaucracy and diversity management suggests a key variable is status distance, that is, how different the majority and minority groups are in terms of relative status in the organization and society (Groeneveld and Meier 2022). As status distance increases between groups in the organization, the quantity and quality of contacts is likely to be reduced and therefore, the critical mass to generate contagion effects would need to be larger.

H4a *The size of the critical mass in aggregate contagion effects will be greater if contact is low due to intraorganizational segregation or greater status differences.*

5.8 | Symbolic representation: Individual level

Unlike active representation which can manifest in three different processes, symbolic representation only occurs when clients react to passive representation in the bureaucracy. Mosher's linkage of symbolic representation and government legitimacy clearly relied on a collective concept of aggregate level representation. He contended that "The passive (or sociological) meaning of representativeness concerns the source of origin of individuals and the degree to which, *collectively*, they mirror the total society" (Mosher, 1968, p. 12; emphasis added). Although the preponderance of symbolic representation studies examine collective representation, the first empirical assessments focused on individual responses to representation in AIDS treatment (Thielemann & Stewart, 1996) and police stops (Theobald & Haider-Markel, 2009) and were subsequently applied to a wide range of issues (Barnes et al., 2018; Gilad & Alon-Barkat, 2018; Murdoch et al., 2021). Symbolic representation is an individual level phenomenon only when it involves a client/citizen interacting with a specific bureaucrat or team of bureaucrats such as a police officer stopping a motorist or a counselor advising a job seeker. In such a case, a critical mass need not be necessary because the contact is with a single bureaucrat who shares the identity. Studying symbolic representation at the individual level is difficult in part because it rarely occurs in isolation from potential active representation impacts. In theory, --symbolic representation can be separated from active representation because the former relies on actions of the client but not the bureaucrat and the latter relies on bureaucratic behavior rather than client behavior. In practice both behaviors can occur simultaneously in a reciprocal relationship where one triggers the other and vice versa (see Headley et al., 2021; Theobald & Haider-Markel, 2009).

Separating active from symbolic representation at the individual level requires specific types of data or methods. Guul (2018) measures both the effort of employment counseling bureaucrats and individual clients; his work shows both processes occurring. Xu and Meier (2021) use qualitative interviews to argue that they find no indication of active representation by female teachers or administrators in girls' education in China. They conclude girls' test score improvement could only occur via symbolic representation and bolster this conclusion by showing that girls with female math teachers have different attitudes toward math and math classes and spend more time on homework. This focus on one-on-one relationships for symbolic representation at the individual level suggests the following hypothesis:

H5 *Symbolic representation at the individual level will not be affected by whether there is a critical mass of bureaucrats.*

Although symbolic representation appears to be a fully individual process where a critical mass of bureaucrats might not matter (other than the aggregation of individual cases), a critical

mass might still play a role in some circumstances. If citizens/clients are expected to invest in greater efforts at coproduction or to disregard skepticism about the intent of bureaucrats, it is important to realize that these contacts take place within the full lived experiences of the citizen/client (Headley et al., 2021; Hellwege et al., 2021; Zamboni, 2020). The citizen comes to bureaucratic interactions with expectations based on previous experiences, what they observe about the world, and their own attitudes. The symbolic representation process also asks the citizen to expend effort to coproduce goods or services or to become more trusting of the bureaucrat. In this regard, one might interpret the citizen as facing a decision to act or not act based on whether acting would generate additional net benefits. A critical mass of passive representation, in this case, might be an additional signal to the citizen that behavior change would pay off. Being urged by a female police officer to provide more information about an assault, for example, could have more credibility if the force has a larger representation of female officers.

H5a *In cases where symbolic representation requires greater effort on the part of the citizen/client, a critical mass of representative bureaucrats will increase client responses.*

Any discussion of symbolic representation whether at the aggregate or the individual level needs to consider one important caveat—symbolic representation is based on expectations of treatment, and the citizen/client sometimes has a stronger indicator of how they will be treated—past treatment. In their study of police-citizen contacts, Headley et al. (2021) present a theory of symbolic representation that explicitly incorporates active representation and how police have treated individuals in the past. They argue that symbolic representation is possible only if there is an expectation of fair or equal treatment on the part of the citizen. As supporting evidence, they examine public attitudes toward the police in two cities with high racial representation on the police force (African American police are actually a majority in one case). Contending that this is the optimal case for symbolic representation, their qualitative interviews show little impact of symbolic representation but rather substantial skepticism of police treatment of minorities. Individual treatment appears to trump symbolic representation even in these situations that are well above any critical mass of representation.

5.9 | Symbolic representation: Aggregate level

Even more than the active representation literature, the study of symbolic representation is focused on aggregate representation (even though the data are often individual level). Thielemann and Stewart's (1996) revealed that AIDS clients favored services delivered by individuals with a similar sexual orientation (see Gade & Wilkins, 2013 on symbolic representation in veterans' policy; Barnes et al., 2018 and Theobald & Haider-Markel, 2009 on police). Several studies indicate women are more willing to report sexual assaults to police, a process that could only occur by symbolic representation because it requires victims to act before contact with a police officer (Meier and Nicholson-Crotty, 2005; Schuck, 2018). A number of vignette experimental studies has linked aggregate bureaucratic representation levels to increased perceptions of legitimacy or willingness to coproduce in policing (Ricucci et al., 2018; Ricucci et al., 2014; Schuck et al., 2021), recycling (Ricucci Van Ryzin and Li, 2016), and automation of traffic enforcement (Miller & Keiser, 2021). Other vignette experiments, however, yielded null results in emergency preparedness (Van Ryzin et al., 2017) and crime control (Sievert, 2021).

Although the vignette experiments are individual level data, the subjects are responding to aggregate levels of representation and should be considered aggregate or collective representation.

Because the stimulus is aggregate (the level of representation), the concept of critical mass is directly involved. The greater the bureaucratic representation is, the more likely that clients will notice the representation, a precondition for symbolic representation.

H6 *Symbolic representation at the aggregate level needs a critical mass bureaucratic representation.*

Existing work on representative bureaucracy suggests that the symbolic representation relationship might be more complex. A recent Asian three-nation study indicates that equity in gender representation, not representation per se, generates the greatest legitimacy and cooperation (Baniamin & Jamil, 2021). Given a recent theoretical argument that the objective of representative bureaucracy is equity not absolute advantage (Meier, 2019) and empirical support for this contention (Fay et al., 2021; Hong, 2017; Keiser et al., 2002; Meier et al., 1999; Nicholson-Crotty et al., 2011), a nonlinear relationship with a second inflection point at the level of equity is a credible hypothesis.

H6a *The critical mass for symbolic aggregate representation statistically should be nonlinear, either a threshold effect, or a nonlinear relationship.*

H6b *The nonlinear relationship between critical mass and aggregate symbolic representation is related to equity of representation rather than absolute level of representation.*

5.10 | Discussion: Extensions and qualifications

This theoretical discussion focused on the concept of critical mass in representation bureaucracy, but Kanter's (1977b) original theory was a general theory of how groups interacted in an organization. Might the arguments presented here on critical mass might apply to other organizational processes? Bureaucrats have multiple identities and, thus, there are many ways to group employees within an organization so that the hypotheses in regard to critical mass might be applied to areas other than representative bureaucracy. Critical mass might be a useful lens to examine how different professional groups within an organization influence policy; the conflict in anti-trust policy between economists and lawyers is a case in point (Eisner, 1991). The logic might be further generalized to other policy disputes without links to different professions (the level of program fraud and the need for administrative burdens, Moynihan et al., 2015, or the relative balance of incentives vs. punishment in regulation). A critical mass might also be relevant to the willingness of street-level bureaucrats to accept policy decisions made by organization leaders or imposed by political decisions. Similarly, the scholarship on diversity management appears directly relevant to the influence of a critical mass.

Potential extensions as well as the application to representative bureaucracy should recognize two significant qualifications. First, the logic and the hypotheses are based on the qualifier "ceteris paribus," that all other things are equal. We have noted at various places that all things might not be equal by suggesting the relationships might be affected by hierarchy position, professionalism, employee segregation, frequency of employee interaction, and reciprocal relationships between active and symbolic representation, among others. These various other factors can enhance the need for a critical mass or how large a critical mass needs to be.

Second, our theorizing was based on an existing literature highly concentrated in a small number of countries (the US and Western Europe, see Bishu & Kennedy, 2020). The logic of a critical mass is that it provides support for bureaucrats seeking to represent or it provides signals to clients that encourage symbolic representation. The meaning of such actions is likely to vary

across countries suggesting that a critical mass might be more important in countries characterized by communitarian rather than individualistic values or in highly centralized bureaucracies rather than decentralized ones (Schröter, 2019). Additional research on critical mass in different countries and types of organizations is clearly needed (e.g., Eckhard, 2021; Gilad & Alon-Barkat, 2018; Murdoch et al., 2020).

6 | TWO EMPIRICAL ILLUSTRATIONS

To illustrate the utility of this theory of critical mass as a guide to research, this section provides two empirical examples on topics that have not been addressed in the literature to date. While critical mass has played a significant role in the aggregate studies of representative bureaucracy, no work has used the concept of critical mass in the context of individual level studies (H1) and no quantitative study of representative bureaucracy has investigated critical mass in contagion effects (H2a).

Both empirical illustrations use the 2013-14 China Education Panel Survey (CEPS); data used by Zhang (2019) and Xu and Meier (2021) to examine gender representation on girls' math scores. CEPS is an individual level data set with a nationally representative sample that includes student test scores and surveys of students, teachers, parents, and school administrators. Students can be matched to specific math teachers. The 2013-14 study includes approximately 20,000 students in 438 classrooms of 112 schools in 28 county-level units in mainland China. Both Zhang (2019) and Xu and Meier (2021) find that girls perform better in math when taught by female math teachers although they use somewhat different estimations. Neither addresses issues of critical mass or contagion effects.

In China, official rhetoric and the Constitution endorse gender equality, but a patriarchal culture starting with a strong son preference and gender selection in abortion limits opportunities in practice. China is ranked 106 out of 153 countries by the World Economic Forum's (2020) 2020 gender gap index using education, health, economic and political factors and 124th on access to secondary education. Gender bias in education is especially deep-rooted in Chinese culture, and cultural stereotypes that men are superior to women in math and science persist despite a lack of objective evidence (Tsui, 2007).

6.1 | Illustration 1. Critical mass at the individual level

Although a critical mass of representative teachers has been found necessary for secondary outputs such as student health outcomes (see Atkins & Wilkins, 2013), it has never been found necessary for test scores; and the hypothesis has not been tested with individual level data. Xu and Meier (2021), in a multiple regression with extensive controls, find that female students with female math teachers score approximately 2.54 points higher on the math exams (about one-fourth of a standard deviation) compared to girls with male math teachers.⁹ To determine if a critical mass of female math teachers affects this representation outcome, we adopt the specification used by Xu and Meier (2021) which controls for the economic status of the student's family, parent education, the teachers' educational training, class size, teacher experience, working hours and other characteristics, school location, fixed effects for schools, and a set of teacher attitudes (see supplemental appendix for operationalizations).

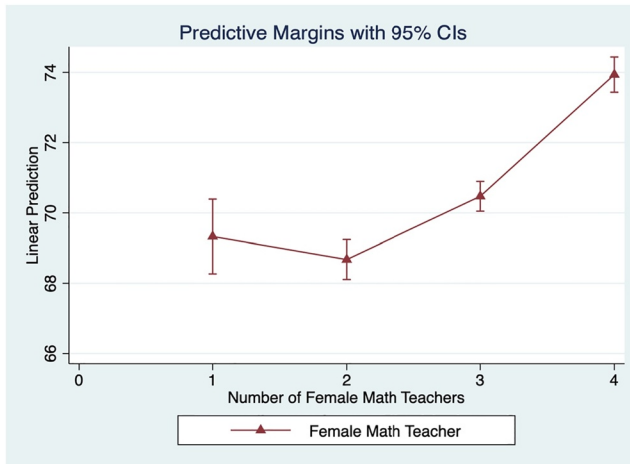


FIGURE 1 Testing for a critical mass with individual level data. *Note:* How female math teachers affect female students grades when there are other female math teachers

The nationally representative sample uses random selection for schools, four math teachers within a school, and then students assigned to the teacher. The specific test for critical mass in our extension assesses if the impact of female math teachers is contingent on whether there are other female math teachers in the school (measured by a set of dummy variables for schools with two, three, and four female teachers).¹⁰ A critical mass effect will be shown as an interaction between the student-teacher gender match and the number of female math teachers.¹¹

The full results of the regression appear in the appendix and show a series of significant relationships. Figure 1 presents the regression estimates of the girls' test scores dependent on the number of female colleagues that a female math teacher has. Girls with a female math teacher who has no female colleagues score approximately 2.6 points higher than girls with a male math teacher or approximately 69.3 overall. Having only a single female colleague has a slight negative dip to 68.7. A nonlinear jump in impact, consistent with a critical mass effect, shows an additional increase of about 1.8 points to 70.5 with two female colleagues and then a larger jump of about 3.3 points to 73.9 with three colleagues. This last case is approximately one-half of a standard deviation improvement and twice the impact that Xu and Meier (2021) find without taking critical mass into consideration.

6.2 | Illustration 2. Contagion effects and critical mass

In the context of the current empirical example, contagion effects occur if male math teachers who have female math teachers as colleagues are associated with higher girls' math scores than the male math teachers who only have male colleagues. This relationship can be examined in the same regression equation as before, but the key coefficients will be the interaction of the male math teachers with the number of female math teachers in the school (either 0, 1, 2 or 3).

The regression in the appendix again shows statistically significant results that are best visualized in Figure 2. A male math teacher with no female colleagues is associated with a mean girls' math score of 68.9. The addition of one female colleague is actually associated with a drop in scores for the male math teacher's students to 66.7 (a decline of 2.2 points) indicating no

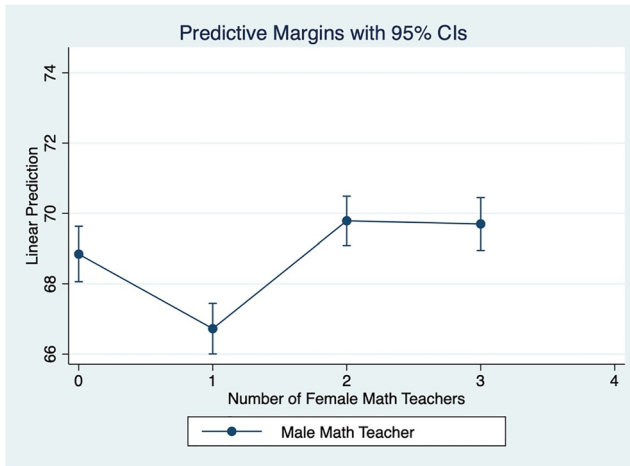


FIGURE 2 Testing for contagion effects with individual level data. *Note:* How male math teachers affect female students grades when he has female math teachers as colleagues

contagion effect at low levels of female representation. For male math teachers with two female colleagues the mean score jumps 69.8 (3.1 points, approximately one-third of a standard deviation) and essentially stays at the level with three colleagues (69.7 points). The pattern shows both a contagion effect and that the contagion effect is enhanced by a critical mass of the representative bureaucrats. Both shifts are statistically significant. In combination the two examples illustrate critical mass impacts on both direct effects of representation (the association of women teachers with girls' math scores) and indirect contagion effects on girls via male math teachers who teach in schools with female math teachers. Substantively, the direct representation effects are larger than the indirect contagion effects as should be expected, but a full accounting of the influence of representative bureaucracy should consider both possible influences.

The two empirical examples illustrate the potential promise of the critical mass theory to contribute new and theoretically important findings to the literature on representative bureaucracy. To date, no *individual level* study of representative bureaucracy has demonstrated that a critical mass of bureaucrats affects the ability to represent. The first empirical example shows that the association between female math teachers and girls' math scores becomes larger with more female math teachers in a school. Similarly no quantitative research has examined contagion effects and critical mass for bureaucratic representation at either the individual or organizational level. The second empirical example shows that when male math teachers have more female colleagues teaching math in the same school, girls' scores in their classes increase. Although the empirical illustrations were limited by the small number of math teachers sampled in each school, they do show how the new critical mass theory can make contributions to one important organizational process.

7 | CONCLUSIONS

The concept of a critical mass of individuals who share a common trait is an interesting theoretical concept both within representative bureaucracy (Raaphorst & Groeneveld, 2019) and for organization theory in general (Tarter & Hoy, 1998). Within representative bureaucracy, it

provides an explanation for some of the null and mixed results in the literature, suggesting that a critical mass is necessary before passive representation generates active or symbolic representation. Several cases exist where a critical mass appears to be a necessary condition for representation (see Atkins et al., 2014; Keiser et al., 2002), and the theorizing here suggested other cases for both active representation and symbolic representation.

In addition to representative bureaucracy, the theory presented here using the concept of critical mass in representative bureaucracy could also inform the broader study of organizations because it links administrative behavior to the organizational context; a linkage that is highly consistent with contingency theory approaches to organizational behavior. These broader ties to organization theory can also help us better understand how representation can be instrumental for the organization and improve efficiency and effectiveness (see Meier, 2020, pp. 11–14).

Despite its promise, the concept of critical mass appears to be underused. To illustrate the potential utility of the concept in the representative bureaucracy literature, we posited a micro-theory of representative bureaucracy along three distinct dimensions: active versus symbolic representation, individual versus aggregate representation/data, and the processes of active representation (individual decisions, policy change, and contagion effects). Although previous empirical work focused on active representation, we illustrate that critical mass is likely to be equally if not more important for symbolic representation particularly in aggregate level studies of collective representation. Within the process of active representation, our micro-theory indicates that a critical mass is likely to be more relevant in studies of policy change and contagion effects than for many individual decisions. Contagion effects are a particularly promising area of research since little literature examines how the presence of minority bureaucrats changes the behaviors of other bureaucrats. Finally, the article finds value in both individual and aggregate studies of representation. The different units of analysis could be linked to established theoretical differences between individual and collective representation similar to a distinction in the legislative representation literature. As a research strategy, each level of aggregation has some advantages in studying some types of representation, and the concept of a critical mass could serve as a bridge between the two approaches.

The core argument is presented in 15 original hypotheses clustered in six groups based on the general logic of a critical mass and how it might operate for both active and symbolic representation. For active representation, further distinctions are made depending on whether representation occurs by making decisions, changing policies, or contagion effects. With a more precise theory on critical mass, we seek to foster research that examines the effects of critical mass and how it differs across various conditions and types of representation. We also illustrate this potential with two original empirical analyses literature based on individual-level Chinese education data.

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DATA AVAILABILITY STATEMENT

All data and documentation necessary to replicate the empirical analysis in this paper can be found at <https://doi.org/10.7910/DVN/NYDHKE>.

ENDNOTES

- ¹ Kanter was interested in inter-group relations and how what she termed “tokens” interacted with and were treated by “dominants.” While her logic can be applied to representative bureaucracy, Kanter discusses “representation” in a sociological sense rather than how it is used in the representative bureaucracy literature.
- ² The causal logic for how critical mass affects active and symbolic representation is similar. Both bureaucrats and clients are influenced by values that are derived from lived experiences and are making choices to either represent or to respond to representation. If the utility of any action is based on the values sought times the probability of attainment, critical mass essentially affects the probability that either the bureaucrat can represent and generate a desired outcome or the client can respond to representation and similarly achieve a valued result.
- ³ The disadvantage of the split sample approach is that it also changes the relationship for all the other variables in the model and thus these changes might affect the size of the representation coefficient. This could be handled via a full interactive model.
- ⁴ Classical work by Long (1952) and Mosher (1968) included both individual representation and a discussion of representation by the bureaucracy as a whole.
- ⁵ Because these critical mass effects might be triggered by symbolic assurance to the bureaucrat that representation is acceptable, even representation cues outside the organization might encourage the bureaucrat to represent. This could be representation government wide or even in political institutions (Meier & Rutherford, 2017).
- ⁶ One exception might be if bureaucrats decide to not enforce a policy or law and this lack of enforcement spreads through the organization without an actual policy change.
- ⁷ The aggregation assumes no inter-group reactivity, that is, that majority bureaucrats do not change their own decisions to further disadvantage minority clients because the organization has more minority bureaucrats.
- ⁸ As an example it should be easier to adopt a policy that allows race to be considered in college admissions or financial aid than to create a quota system.
- ⁹ Our analysis follows the convention in the literature to examine girls scores only, comparing how they do with different gender math teachers. The starting with Keiser et al. (2002) has long noted that boys perform better with female math teachers than they do with male math teachers, but the difference for girls is greater than the difference for boys. Xu and Meier (2021) also note this in their analysis of these data.
- ¹⁰ We assume a sample of four teachers reflects the gender of math teachers at that grade level in the school. The average school in the sample has 365 students per grade. Given the large class size of Chinese schools (51 students on average), this translates to seven math classes at the testing grade level. Given the large percentage of math teachers in each school who are in the sample, the sample should on average approximate the gender distribution of math teachers.
- ¹¹ We use the series of dummy variables because we only have data of four math teachers per school, and this method is more sensitive to nonlinear effects than a quadratic estimation with four points.

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APPENDIX A: OPERATIONALIZATION OF INDEPENDENT VARIABLES

The key independent variable is a dummy variable of math teacher's gender, where 0 represents a male math teacher and 1 represents a female math teacher. The regression equation also includes a set of controls that are fairly standard in education production functions. For each student, we include the socioeconomic status of the students' families and the highest level of education of students' parents; both are consistently related to student performance in the literature. At the teacher level, we control for the education levels of teachers and total years of experience; both should be positively linked to performance. Other variables involve school management, including how satisfied teachers are about salaries and school management; the teachers' workload is represented by the total class hours, total working hours per week, average number of students in classrooms, and how much social pressure teachers face from the social environment.

School level control variables include the education level of school principals and the location of schools. Since schools in rural areas receive fewer resources than urban ones, city schools may have better grades. We also include several management variables at the school level, including whether the school offers classrooms for students to study after-school. We expect that students in schools that offer night study rooms would have more time to study and higher grades. In addition, the student test scores are normed by school to create a school fixed effect that should account for any unmeasured differences among schools.

APPENDIX B: FULL REGRESSION RESULTS FOR THE EMPIRICAL ANALYSIS

Variables	Interaction with number of female math teachers Model 1
Female math teacher	2.60*** (0.65)
0 female math teacher	2.12*** (0.55)
2 female math teachers	3.06*** (0.52)
3 female math teachers	2.97*** (0.55)
4 female math teachers	4.61*** (0.61)
Female math teacher × 2 female math teachers	−3.72*** (0.78)
Female math teacher × 3 female math teachers	−1.83** (0.79)
Economic status of students' family, somewhat poor	1.17* (0.642)
Economic status of students' family, moderate	1.96*** (0.61)
Economic status of students' family, somewhat rich	1.44* (0.77)
Economic status of students' family, very rich	−4.38* (2.44)
Highest education level of students' parents, finished elementary school	6.12*** (1.95)
Highest education level of students' parents, junior high school degree	7.69*** (1.93)
Highest education level of students' parents, technical secondary school or technical school degree	8.72*** (1.97)
Highest education level of students' parents, vocational high school degree	8.41*** (2.06)
Highest education level of students' parents, senior high school degree	8.64*** (1.94)
Highest education level of students' parents, junior college degree	11.10*** (1.97)
Highest education level of students' parents, bachelors degree	11.54*** (1.95)
Highest education level of students' parents, masters degree or higher	12.06*** (2.13)

Variables	Interaction with number of female math teachers Model 1
Teacher- highest degree, junior college degree	-2.71 (2.66)
Teacher- highest degree, bachelor degree (attained through adult higher education)	-1.35 (2.64)
Teacher- highest degree, bachelor degree (attained through regular higher education)	-0.32 (2.66)
Teacher- highest degree, master degree or higher	0.92 (2.73)
Whether school offers night study room	2.44*** (0.29)
Average seats in each classroom	-0.042** (0.017)
Teacher- class hours per week	0.043* (0.022)
Teacher- total working hours per week	-0.0060 (0.0071)
Teacher- years of experience in teaching	0.021* (0.011)
Teacher- pressure on public opinions about teacher	-0.34*** (0.12)
Teacher- satisfaction on salary	0.91*** (0.12)
Teacher- satisfaction on school management	0.034 (0.14)
School location, outskirts of the city/town	-1.21*** (0.41)
School location, rural-urban fringe zone of the city/town	-4.55*** (0.34)
School location, towns outside of the city/town	-3.95*** (0.38)
School location, rural areas	-2.26*** (0.38)
Private school	-1.454*** (0.50)
Constant	58.67*** (3.54)
Observations	7491
R-squared	0.156

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.