NETWORK CENTRALITIES, DEMOGRAPHIC DISPARITIES, AND VOLUNTARY PARTICIPATION

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Abstract. This article explores racial and gender disparities in civic-network centrality using various social network methods and regression models. We find that civic networks of women and whites exhibit greater network centrality than their counterparts do. Religious organizations are the hub of civic networks, while labor unions and ethnic/civil-rights organizations are more peripheral. Whites tend to have job-related and nondomestic organizations as the core of their civic network. Women rely on domestic organizations and show little advantage over men in overlapping memberships of voluntary associations. These findings provide a more holistic view of racial and gender disparities in social networks.

1. Introduction. Voluntary participation has long been viewed as an essential component of democracy. Social scientists following a neo-Tocquevillian tradition argue that social integration, quality of public life and the performance of social institutions are all affected by civic engagement [25, 35, 52]. While existing research focuses on how civic engagement is moderated or influenced by various socio-demographic variables [22, 35], we argue that the structure of civic networks can also exert a profound effect on institutional resources and life chances available to a socio-demographic group. On the one hand, participation in a voluntary organization consisting of members with similar background may cultivate bonding ties, strengthen community-based identities, intensify inward-focused behaviors, reduce exposure to new ideas, and exacerbate existing social cleavages [10, 48, 43, 46, 63, 18, 62]; on

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the other hand, by being members of multiple voluntary organizations an individual could crosscut social boundaries and bridge different social groups. These bridging ties can in turn help embed the associations into a broader organizational structure of the society [4, 47]. Yet, scholars should first understand structural variations of civic networks across socio-demographic groups before evaluating the influence of civic networks on a particular socio-demographic group. This research thus investigates race and gender disparities in civic networks with a focus on network centrality.

2. Gender and racial disparities in network centralities. Previous studies suggest gender and race are two essential factors shaping social status, access to social resources, and social well-being in general. Gender disparities are observed since childhood/adolescent yet they tend to vary with different outcomes. Female adolescents are more likely to have negative self-reported health but male adolescents are more likely to be physically bullied in school [1, 20, 21]. For general populations, salient gender disparities are observed in education, income, physical health, mental health, and other aspects of social life across different countries [23, 8, 19, 34, 27, 24]. Race is widely regarded as a fundamental aspect of social stratification in the United States and is believed to be associated with various social problems, such as inner-city poverty, residential segregation, and teenage birth [60, 36, 40]. Even within minority groups, Hunter shows that light skin is associated with higher educational attainment and earnings for women of color [32]. It has been well documented that social networks are segregated by gender and race such that it is easier for white men than minorities and women to access social resources [42, 55]. This article investigates in detail gender and racial disparities in network centralities. A civic network consisting of various voluntary associations is viewed as having a centralized structure if there are one or a few central (types of) organizations within the network. In contrast, a decentralized network has multiple clusters of intensely connected organizations, linked by few, sparse relations [26, 3]. Many argue that the centralization of power is a structural device for handling internal division, preventing factionalism, and achieving collective goals [39, 26, 13]. In contrast, a decentralized network structure is believed to be more adaptive to (dramatic) environmental changes [3, 13]. However, mobilization processes in a decentralized network tend to depend on mutual agreement among interested parties, which could be costly and ineffective [3]. From a network centrality perspective, racial and gender disparities in civic networks could be understood in two ways. First, these disparities create a unique opportunity structure for a specific racial and gender group and perpetuate a social system that is substantially ordered by race and gender. For example, as voluntary associations provide important social settings for social interactions, members in the same association not only influence one another’s behaviors but also act as a major information source about their outer world. Segregation in civic networks will prevent the flow of useful information to certain demographic groups [44, 49, 50, 53]. Second, racial and gender groups can benefit from overlapping memberships of voluntary organizations. Citizens may belong to several voluntary associations, and such overlapping memberships serve as bridging ties connecting various voluntary associations into civic networks [9, 2, 6, 51]. Overlapping memberships provide communication and reduce potential conflicts among associations [61, 7]. From a resource-mobilization perspective, these bridging ties are an important means by which organizations access external resources, achieve internal goals,
and control environmental uncertainty [33, 41]. Existing studies on the centrality of civic networks have also identified overlapping memberships as a specific form of social capital [13], no matter whether an individual organization [3] or a certain form of voluntary associations [12] is considered to be an actor of civic networks. If members of a focal organization also participate in other organizations, the focal organization is structurally embedded in the broader organizational network and tends to establish alliances with other organizations [29, 12]. Organizations that are well connected to others often grow faster and obtain a wider range of resources than structurally isolated and closed organizations [57]. Studies show that overlapping memberships are important ties helping a specific stakeholder group to translate common interests into action [53]. If members of a focal organization are not active in the broader community, this focal organization may fail to gain trust, endorsement, and support from other organizations and becomes less effective in achieving its objective [12].

3. Data. This study is based on a nationally representative random-digit-dial (RDD) survey of individuals aged 22-65 in the United States. Around 3000 interviews were completed from November 2004 to March of 2005. The response rate was 43 percent, which is comparable to other national RDD telephone surveys [28]. The raking procedure in STATA was used to construct sample weights and match socio-demographic characteristics of the sample to the 2005 Current Population Survey estimates. Information about socio-demographic characteristics (e.g., race, gender and education) and voluntary participation was collected. Voluntary participation was collected by two-mode affiliation networks, which consist of a set of actors (or respondents) and a list of nine voluntary associations to which these actors are connected. To analyze overlapping memberships, the affiliation networks are transformed into one-mode networks [59]. \( A \) is the affiliation matrix with rows indicating the actors and columns as voluntary organizations these actors affiliate with. To get the nine by nine civic network \( X \) showing relations among voluntary associations, one needs to multiply the transpose of \( A \) by a matrix \( A \) itself [59, 5, 7].

\[
X = A^T A
\]

Network analysis is mainly based on \( X \), which is implemented by UCINET 6 [5]. Affiliation matrices are normalized and thus free from the influence of different membership rates across associations [12].

4. Results. Most respondents (74.0%) are members of at least one of the nine listed voluntary associations and more than half of them (52.4%) hold memberships in two or more associations. Membership percentages of nine voluntary associations across racial and gender groups are shown in Table 1. Overall, religious groups have the highest membership rate, which is consistent with previous findings that church-related groups constitute the most common form of voluntary organizations in America [52, 54, 4]. Not surprisingly, joining labor unions and ethnic/civil rights organizations is the least popular way of voluntary participation [12]. Women are more likely to join in popular forms of voluntary associations (e.g., religious groups, charities, and school and PTA), while men tend to participate in other less common associations. As compared to whites and blacks, Latinos show lower membership rates across all nine voluntary associations.

Two measures are adopted to compare the centralization tendencies of civic networks across racial and gender groups. The first one is a (group) degree centrality
Table 1. Membership percentages of nine types of organizations and degree centralization

| Organization type             | Membership percentages |
|------------------------------|------------------------|
|                              | All | Male | Female | Whites | Blacks | Latinos |
| Religious groups             | 38% | 34%  | 42%    | 42%    | 40%    | 25%     |
| Charities                    | 25% | 23%  | 27%    | 27%    | 28%    | 15%     |
| School and PTA               | 24% | 17%  | 31%    | 25%    | 32%    | 21%     |
| Professional organizations   | 23% | 24%  | 22%    | 26%    | 19%    | 11%     |
| Political parties            | 23% | 23%  | 22%    | 26%    | 17%    | 11%     |
| Leisure and sports groups    | 22% | 25%  | 19%    | 24%    | 16%    | 13%     |
| Neighborhood organizations   | 13% | 13%  | 13%    | 13%    | 19%    | 8%      |
| Labor unions                 | 12% | 15%  | 9%     | 12%    | 17%    | 6%      |
| Ethnic/civil rights          | 3%  | 4%   | 3%     | 2%     | 9%     | 3%      |
| Freeman degree centrality    | 23.56 | 27.27 | 26.1   | 25.01  | 25.28  |
| Network heterogeneity        | 1.59 | 2.18 | 2.24   | 0.92   | 1.77   |

measure proposed by Freeman [15]. A perfect centralized network takes the form of a star network where all organizational ties are connected and only connected to a core actor. This centrality measure takes a star network of the same size as a reference, calculates the sum of deviations between the degree of each actor and the maximum degree in the observed network, and then contrasts this sum of deviations with that calculated from a star network. Having a higher value means a higher degree of centrality. The other measure is based on degree variance and referred hereafter as network heterogeneity. As discussed above, the first measure relies on the maximum degree in the observed network and is less sensitive to degree heterogeneity. To take degree heterogeneity into account [56, 59, 11, 39], the second measure calculates the degree variance (or standard deviation) and then compares it with the maximum possible variance (or standard deviation) calculated from a reference network (e.g., a star network). This measure evaluates network centrality from the aspect of degree heterogeneity and attains its minimum value of zero when all degrees are equal.

Table 1 also presents the values of the two measures to compare the centrality of civic networks across racial and gender groups. Men and blacks show lower values of Freeman’s degree centrality than their counterparts, respectively. Yet, such racial or gender disparities in the centrality of civic networks are small given that little variation is observed in Freeman’s centrality across different demographic groups. The disadvantages of men and blacks in the centrality of their civic networks become more salient if the second measure, network heterogeneity, is employed. For example, network heterogeneity of whites is more than twice that of blacks. Although the values of two centrality measures are not directly comparable, these findings do suggest the existence of racial and gender disparities in civic networks.

After identifying centralization tendencies of civic networks, we use Bonacich power centrality to examine which voluntary association assumes a more central role in a civic network across racial and gender groups. Given that a central actor can be defined in multiple ways, Bonacich centrality not only considers its number of ties with other actors but also weighs the importance of these ties by the degree of these actors one connects to. In other words, one can be more powerful by connecting to neighbors with more connections. The normalized Bonacich power
centrality scores are summarized in Figure 1 and Figure 2. The most striking finding is that religious group tends to be the most central organization in civic networks and this conclusion holds across demographic groups. Charity organizations also occupy central positions in civic networks but their advantage over other voluntary organizations (e.g., professional or leisure/sports groups for men) for a specific demographic group can be trivial.

Compared to men’s civic networks, schools and PTAs are more central but leisure/sports groups, political parties, professional groups, and labor unions are less central in women’s civic networks. It is useful to interpret this interesting finding in light of the McPherson-Smith-Lovin typology of civic organizations [44]. This typology groups various civic organizations into three major forms according to social contacts provided by these organizations: (1) domestic organizations such as religious groups, charities, PTAs, and neighborhood organizations, which are community-focused and family-oriented; (2) nondomestic organizations consisting of leisure/sports/culture organizations, political parties, and ethnic or civil rights groups; (3) work-related organizations, including labor unions and professional organizations. Using this typology, domestic organizations are more central than either nondomestic or work-related organizations in women’s civic networks, whereas nondomestic and work-related organizations are more central in men’s network. This distinction, in turn, helps us understand the gender inequality in civic networks: men’s civic network is more likely to provide information and resources about possible employment and business opportunities, while women’s civic network is more effective in addressing domestic and neighborhood issues.

Figure 2 shows that Bonacich centrality scores vary substantially across racial groups: professional, political, and leisure/sports organizations are more central.
in the civic network of whites, while school-based groups, neighborhood associations, labor unions, and ethnic or civil rights organizations are more central in the civic network of nonwhites. When adopting the three-form typology of civic organizations, nondomestic and work-related organizations appear to be better embedded in the networks of whites and thus play a more crucial role in their civic life. More specifically, within nondomestic organizations, those powerful ones according to Bonacich power centrality scores (e.g., political parties) are more central in whites’ networks, but less powerful ones (e.g., ethnic or civil rights groups) are more central in nonwhites’ civic networks. The same pattern can also be observed in work-related organizations where professional organizations are more central in whites’ civic network but labor unions are more central in the networks of nonwhites. These patterns suggest that whites are more capable of utilizing powerful institutions such as professional organizations and political parties, while minorities cannot take advantage of these institutional resources as effectively as whites do.

By making the node size proportionate to its degree centrality, Figure 3 presents the network centrality of the sample’s civic network in a graphical way. As expected, religious groups become the hub of the civic network, which maintains strong connections with other core organizations (e.g., charity and professional groups) and weaker connections with peripheral organizations (e.g., labor unions and ethnic/civil rights groups). As the number of overlapping members between two given nodes defines the tie strength, Figure 3 suggests the internal link between network centrality and overlapping memberships, which warrants further investigation.

We argue that the centrality of civic networks is related to overlapping memberships of both different voluntary associations and different types of voluntary associations. The latter matters because, following the McPherson-Smith-Lovin typology of civic organizations, overlapping memberships of domestic, nondomestic

**Figure 2.** Bonacich power centrality scores for civic networks by race

Note: The centrality scores are normalized by the highest centrality in each network.
and work-related organizations can bring more heterogeneous social contacts, resources, and information. This research next investigates how these two types of overlapping memberships are influenced by socio-demographic variables, especially race and gender [3, 30]. If participating in one specific voluntary organization is treated as an event, the count of these events, or the total memberships of different voluntary associations reported by a respondent, can be analyzed by Poisson regression [38]. One major assumption of Poisson models is that the average of counts must be equal to their variance. Yet, this assumption is often violated by overdispersion (i.e., greater variability than would be expected based on a Poisson model) and excess zeros (e.g., more people reporting no voluntary participation than would be expected based on a Poisson model) in empirical applications [37]. The latter deserves attention in social network analysis because social isolation has been identified as a challenge in America [45, 14]. Negative-binomial regression and zero-inflated models are used to address overdispersion and excess zeros, respectively [16, 17]. Vuong tests are conducted to examine whether zero-inflated models perform better than corresponding models without zero inflation.

To investigate overlapping memberships of different voluntary associations, Table 2 shows that all covariates in both Poisson and negative binomial regression models are significantly associated with memberships of more voluntary associations (levels of significance: *** p < .001 ** p < .01 * p < .05). Yet, results from Vuong tests provide strong evidence of zero inflation. Zero-inflated Poisson
and zero-inflated negative binomial models are then employed to analyze voluntary participation. These models with zero-inflation reveal different patterns from those without zero-inflation: neither female nor whites is significantly associated with more memberships, although age, education, being married, religious affiliation and perceived social class still have positive effects on memberships of voluntary organizations.

Next, a multinomial logistic regression model is employed to investigate overlapping memberships of three forms of voluntary organizations – domestic, nondomestic, and work-related organizations [44]. An overlapping membership is identified if a respondent participates in any two of the three forms of organizations and no overlapping membership between either two of the three forms is treated as the reference group (also see Table 2 for results). Across the three scenarios (domestic & nondomestic, domestic & work, nondomestic & work), no gender disparity in overlapping memberships is observed. Whites are significantly associated with the presence of overlapping memberships between domestic and nondomestic organizations. Both whites and blacks are more likely to possess overlapping memberships between domestic and work-related organizations. For other covariates, education and income allow respondents to bridge the three forms of voluntary organizations.

To understand racial and gender disparities in overlapping memberships, we show the similarity of membership profiles using the multidimensional scaling procedure (MSP). The MSP is a visual presentation of similarity or clustering among actors/nodes and similarity is defined by the extent that the two nodes have similar shortest paths to all other nodes [31]. Figure 4 presents the solutions for gender networks. For males, their core organizations consisting of sports/leisure, charity, political, professional, and religious groups are tightly clustered, which means that their membership profiles are virtually the same. The same, albeit less concentrated, pattern can be found in the civic network of females. Because memberships of the core organizations in men’s civic networks are more similar, it is relatively easier for men to dance between these core organizations. Meanwhile, for both genders the ethnic/civil rights groups and labor unions are further apart from core organizations, suggesting that their members are not as socially entrenched as these from core organizations [12]. The major gender difference is the distance of school and neighborhood organizations to the core organizations. The two domestic organizations belong to the core organizations for women but this conclusion does not hold for men.

The MDS also reveals salient racial disparity (see Figure 5). For whites, the membership profiles of their core organizations are highly similar, which may facilitate overlapping memberships among these core organizations. Consequently, whites can mobilize various resources and take advantage of different social institutions. In contrast, for Latinos and blacks, their membership profiles of various organizations are less similar. Moreover, their core organizations appear to be domestic, while peripheral organizations tend to be nondomestic and work-related. Although these domestic institutions, such as churches, charities, and neighborhood organizations, are particularly important in providing social resources to minorities [58], the over-reliance on domestic organizations may limit their access to more heterogeneous resources and information. In both Figures 4 and 5, labor unions are isolated from the core organizations, which is in line with existing research showing that unions are more peripheral than other voluntary associations in American civic life [58].
Table 2. Results from multinomial logistic regression, Poisson regression and negative-binomial regression on voluntary-organization memberships (N=2,456)

|                      | Poisson regression | Negative-binomial regression | Multinomial regression |
|----------------------|--------------------|-------------------------------|------------------------|
|                      | Zero-inflation     | Zero-inflation               | Domes. & Non.          |
|                      | Coeff.             | Coeff.                        | Coeff.                 |
| Whites (ref: Latinos)| 0.176***           | 0.179**                       | 0.454***               |
| Blacks (ref: Latinos)| 0.329***           | 0.337***                      | 0.26                   |
| Female (ref: male)   | 0.069*             | 0.069*                        | -0.067                 |
| Married              | 0.149***           | 0.152**                       | 0.277**                |
| Age                  | 0.006***           | 0.006***                      | 0.008                  |
| Education c          | 0.229***           | 0.224***                      | 0.153***               |
| Religious affiliation| 0.274***           | 0.269**                       | 0.396**                |
| Perceived social class| 0.141***         | 0.142**                       | 0.431***               |
| Annual income        | 0.007***           | 0.007**                       | 0.017*                 |
| Constant             | -2.094***          | -2.110***                     | -6.286***              |
| Chi square           | 492.26***          | 467.43***                     | 357.07***              |
| Pseudo R2            | 0.072              | 0.052                         | 0.089                  |
| Alpha                | 0.144              | 0.017                         |                       |
| Vuong test           | 5.84***            | 4.70***                       |                       |
Figure 4. Multi-dimensional scaling solution of civic networks by gender.
5. Conclusion. This study not only investigates the demographic features of civic networks but provides a more holistic view of racial and gender disparities from a
network-centrality perspective. Using various measures of network centrality, techniques of network analyses and regression models, we identify several important patterns of racial and gender disparities in civic-network centrality. As measured by Freeman’s degree centrality and network heterogeneity, the civic networks of women and whites generally exhibit greater network centrality than their counterparts do. Religious organizations tend to be the hub of different civic networks but labor unions and ethnic/civil rights organizations are more distant from other organizations. Voluntary organizations focusing on domestic issues are more central in women’s civic networks and more powerful institutions, as defined by Bonacich power centrality scores, tend to be core organizations in whites’ civic networks. In terms of overlapping memberships, Latinos are significantly associated with fewer memberships of voluntary organizations. Taking zero inflation into account, women are not more likely than men to engage in more (forms) of voluntary organizations.

Based on the McPherson-Smith-Lovin typology of civic organizations, this study also enriches our understanding of demographic variations in civic networks. In terms of gender disparity, domestic organizations are better embedded in women’s civic networks, whereas work-related organizations (e.g., professional associations and labor unions) and nondomestic organizations (e.g., political parties and ethnic/civil rights organizations) are more central in men’s networks. This disparity in civic networks perpetuates gendered division of labor and allows men to benefit from more heterogeneous institutions outside the family. For racial disparity, nondomestic and work-related organizations are more embedded in the civic network of whites but less central to the civic life of nonwhites. These latent clusters of voluntary associations deserve further attention.

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