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# A Note on Sociometric Order in the General Social Survey Network Data

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# A Note on Sociometric Order in the General Social Survey Network Data

*The people identified as important discussion partners in the GSS network data were cited in order of strength of relationship with respondent; the first cited person having the strongest relation, the second having the next strongest, and so on. On average, the third citation is a turning point. There is a steep, linear decline in relationship strength across the first three people cited as discussion partners and a slower, but continuing decline, across the fourth and fifth people cited. Order effects on closeness and contact frequency are described in the context of network size and relation content. There is a kinship bias only in deciding who to name first; spouses tended to be the first discussion partner cited and other kin tended not to be. There is a sex homophily bias across all respondents -- people of one's own sex were cited as discussion partners before members of the opposite sex -- but it emerged differently for men and women. Women, especially married women, expressed sex bias in the people with whom they spent time while men expressed sex bias in the people with whom they felt close. Men claimed closer relations with women than men but in fact listed their important discussion partners in descending order of closeness and began the list with the names of other men. Finally, there is evidence of a co-worker bias in discussion relations beyond the family; respondents tended to mention co-workers as daily contacts but late in their list of important discussion partners. With the exception of the spouse bias, all evidence of content bias is markedly weaker than the consistent tendency for respondents to list discussion relations in descending order of closeness and contact frequency.*

It is typically assumed that names generated by a sociometric question are generated in descending order of importance -- the first named is most important to the respondent, the second named is of equal or less importance, the third named..., and so on. This assumption is explicit in analyses using citation order as a measure of relationship strength. The assumption is implicit in decisions to limit the number of sociometric citations. Implicit in the convention of recording only the first three people cited, for example, is the assumption that the people who would have been cited fourth, fifth or later are less important to the respondent than the persons mentioned first, second and third.

There are other criteria by which respondents could be listing names. For example, there is mounting evidence of contact frequency and closeness being independent components in the strength of relationships (Marsden and Campbell, 1984; Burt, 1985). Respondents could be citing people in order of closeness (from closest to less close relationship) or in order of frequency (from daily contact to less frequent contact or from most recent contact to less recent contact). Further, closeness and frequency could be mixed with citation order in some unknown way. For example, Fischer (1982:38, 289) mentions the

problem of respondents failing to cite persons so deeply involved in the respondent's life that they are taken for granted, spouses often being cited after respondents had reviewed their sociometric citations on diverse contents and realized the omission of spouse. Further still, frequency and closeness could be variably relevant to different kinds of respondents. For example, Burt (1983) finds that low socioeconomic status respondents rely more than high SES respondents on frequency as a criterion for sociometric citations. Finally, names could be elicited by content criteria rather than formal criteria. For example, Wellman (1979) finds that kin are likely to be the first people mentioned in response to a "closeness" name generator while co-workers tend to be the last people named.[1]

These variations from the order assumption can make it difficult to test structural hypotheses. A hypothesis about the structure of closeness need not apply to data on contact frequency. Personalities are critical to feelings of closeness. Geography and the physical structure of buildings are critical to contact frequency. More obviously, a social structural hypothesis need not apply equivalently to kinship and co-worker relations.

The General Social Survey network data provide an opportunity to rigorously study the correlates of sociometric order. In contrast to the usual sociometric data obtained from a small number of individuals in a case study, and in contrast to the sociometric data obtained in the above cited studies of large probability samples of a neighborhood, city, or limited geographical region, the GSS network data describe discussion relations elicited from a national probability sample of Americans. Each of the 1,534 respondents was asked: "Looking back over the last six months, who are the people with whom you discussed matters important to you?" Diverse data were recorded on relations with the first five people named by the 1,531 answering the question.[2]

## ORDER EFFECTS

The strength of relations between respondent and discussion partner can vary in closeness and contact frequency. Under the order assumption, discus-

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[1]A proviso here is that Wellman carefully instructed respondents to cite people in descending order of their closeness to the respondent (Wellman, 1979:1209n). My concern is with order effects in citations elicited by the more typical name generator providing no instructions on the order in which names are to be listed.

[2]Burt (1984) provides a detailed discussion of the data and various issues taken into account by the GSS Board of Overseers in their deliberations over the network items.

sion partners should be named in descending order of closeness to the respondent and frequency of contact with the respondent.[3]

Closeness data are graphed in figure 1. After naming his discussion partners, the respondent was asked whether or not he felt equally close to everyone named or closer to some than others. If closer to some, he was asked to name those to whom he felt especially close. Three categories of closeness are created as reported in figure 1; especially close, equally close, and less close.

The top graph in figure 1 shows that especially close discussion partners tended to be named early in a respondent's recitation of names and less close discussion partners named last. Of the 1392 people named first, 27% were especially close to the respondent. This percentage decreases across citation order to 14% of the people named fifth. Of the first named discussion partners, 10% were less close to the respondent, a percentage increasing to 39% of the discussion partners named fifth. Closeness clearly decreases across successively named discussion partners.

Network size is an obvious confounding factor here. In order to be cited fifth, for example, a person had to occur in a network of five or more discussion partners. Further, it seems reasonable to expect a large network to contain more weak relationships than a small network. The bottom graph in figure 1 shows that this is true, but only half of the picture. Larger networks contain more less close relations at the same time that they contain more especially close relations. Closeness neither decreases or increases with network size. Rather, variability in closeness increases as network size increases.

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[3]Length of acquaintance is a third indicator of relationship strength, but shows no order or size effects so I have not given it any attention in the text. Relations could have been formed within the last three years, between three and six years ago, or more than six years ago. In a three-way tabulation of respondent to discussion partner dyads across this length of acquaintance trichotomy against citation order (1, 2, 3, 4, 5) and network size (1, 2, 3, 4, 5+), order is independent of acquaintance (12.43 chi-square statistic, 19 df, $p \sim .9$) and network size is independent of acquaintance (21.46 chi-square, 19 df, $p \sim .8$). These, and all chi-square statistics to be presented, are likelihood ratio statistics. Thirty structural zeros are created in this table when the order variable is larger than network size and are deleted from the calculations. The 4,445 dyads in this table were elicited from 1,519 respondents citing one or more discussion partners. Similarly weak results are obtained with dichotomous length of acquaintance variables. In as much as routine statistical tests define an upper limit of statistical significance (see footnote 6), it is safe to say that the null hypothesis cannot be rejected in this table.

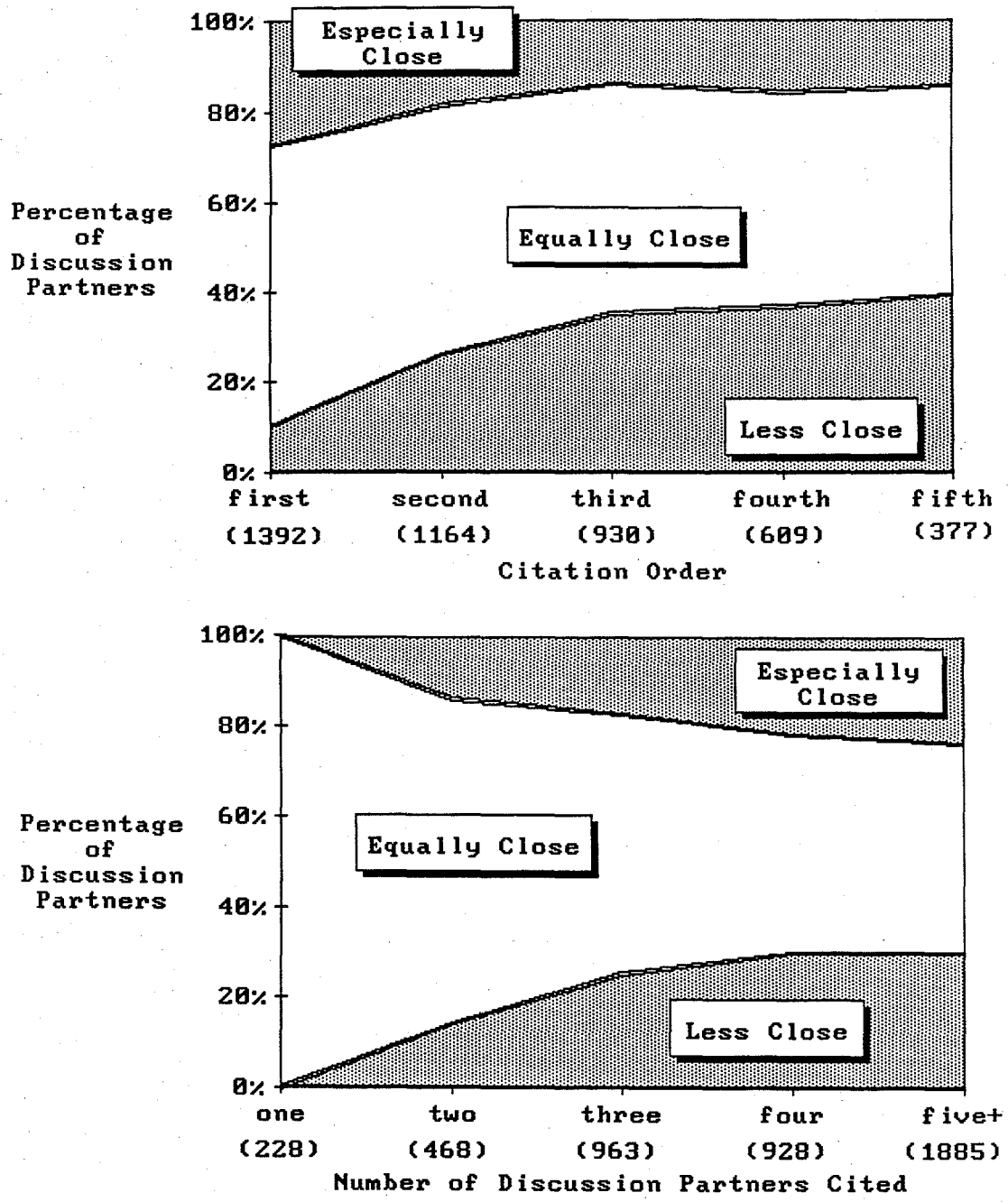


**Figure 1**

**Closeness by Citation Order and Network Size**

These tendencies are nonrandom.[4] In a tabulation of closeness by sociometric order by network size, the hypothesis that closeness is independent of sociometric order generates an unacceptable 305.50 chi-square statistic with 19 degrees of freedom for trichotomous closeness ($p < .001$) and a 192.28 statistic with 9 degrees of freedom for a dichotomy between close relations and less close relations ($p < .001$).[5] Closeness is less contingent on network size, but independence is rejected by a 132.46 chi-square statistic with 17 degrees of freedom for trichotomous closeness ($p < .001$) and a 16.37 statistic with 8 degrees of freedom for dichotomous closeness ($p < .05$). Judging from the absolute and relative magnitudes of these test statistics, closeness is contingent on both network size and sociometric order, but much more strongly contingent on citation order.[6]

Contact frequency data are graphed in figure 2 and present a simpler picture. For each of the first five discussion partners, respondents were asked whether they met with the person daily, weekly, monthly, or less than monthly. So few discussion partners were met less than monthly (5%) that they are combined with the monthly contacts in figure 2. In contrast to closeness, contact frequency shows consistent size and order effects. Among the 1390 first named discussion partners on whom frequency data are available, 64% are daily contacts and 12% are contacted once a month or less (top graph in figure

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[4]The reported results are taken from a three-way tabulation of respondent to discussion partner dyads across citation order (1, 2, 3, 4, 5) by network size (2, 3, 4, 5+) by closeness (2 or 3 categories as reported). Networks with only one discussion partner are excluded from the table because relations are equally close by questionnaire design. Further, structural zeros are created when the order variable is larger than network size and are deleted from the computations (18 for trichotomous closeness, 12 for dichotomous closeness). The 4,244 dyads in the table were elicited from 1,167 respondents citing two or more discussion partners.

[5]The dichotomy between especially close and equally close relations versus less close relations is reported here because it will be used when the tabulation is expanded to include additional control variables. The dichotomy is suggested by two classes of effects: (a) "Especially close" and "equally close" discussion partners are likely to be especially close to other discussion partners while "less close" discussion partners are likely to be strangers to other discussion partners. (b) The loglinear interaction effects between order and closeness show that (net of univariate frequencies) "especially close" and "equally close" relations are less frequent with increasing citation order while "less close" relations are more frequent.

[6]Routine statistical inference is imprecise here because the respondent to discussion partner dyads are not independent observations. Dyads elicited from different respondents are independent, but the one to five elicited from a single respondent are not independent. The more interdependent the discussion partners named by a respondent, the higher the intraclass correlation within respondent networks, and the more that routine test statistics computed from dyads exaggerate statistical significance. In the absence of any systematic correction for correlation between dyads within respondent networks, I report routine statistical tests and rely on the relative magnitude of test statistics. Note that routine statistical significance in this case is an upper limit on the actual significance of effects.

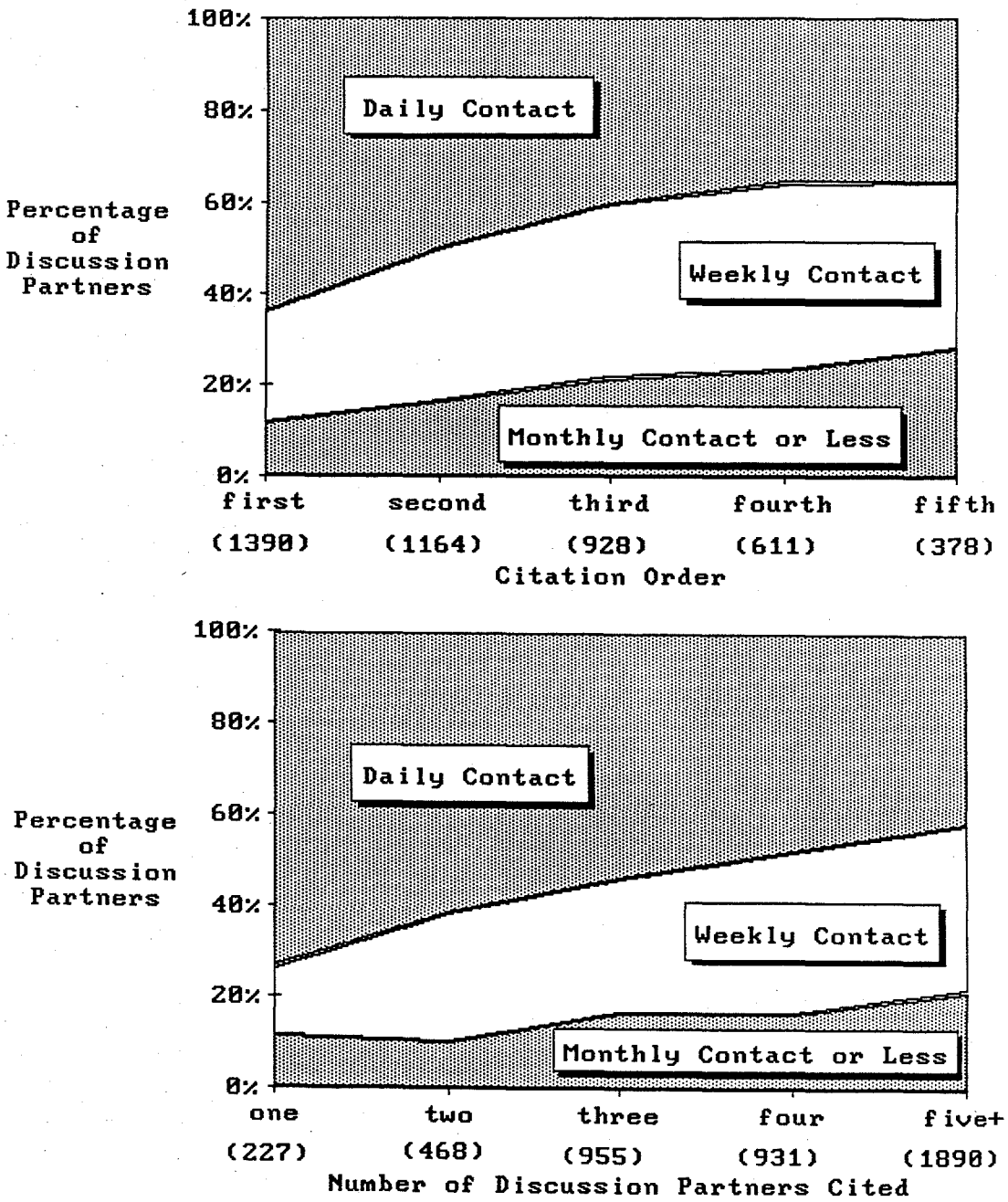


**Figure 2**

**Contact Frequency by Citation Order and Network Size**

2). Daily contacts decrease across citation order to 36% of the fifth named discussion partners. Monthly or less contacts increase to 28% of the fifth named discussion partners. The association with network size at the bottom of figure 2 is similar. Respondents naming only one discussion partner tended to meet that person daily (74%). Contact frequency decreases with network size to 42% of discussion partners being met daily by respondents citing five or more people. Weekly and less frequent contacts are increasingly likely in networks of increasing size.

These tendencies too are nonrandom.[7] In a tabulation of contact frequency by sociometric order by network size, the hypothesis that frequency is independent of order generates an unacceptable 136.69 chi-square statistic with 19 degrees of freedom for trichotomous frequency ($p < .001$) and a 125.97 statistic with 9 degrees of freedom for a dichotomy between daily contact and weekly or less contact ($p < .001$).[8] Contact frequency is less contingent on network size, but the independence hypothesis seems unlikely (48.13 chi-square for trichotomous frequency, 19 df, $p < .001$; 35.25 chi-square for dichotomous frequency, 9 df, $p < .001$).

These results are summarized in figure 3 with graphs of the additive loglinear effects on closeness and contact frequency at each level of sociometric order and network size. Effects are taken from saturated loglinear models of the three-way tabulations described above. An effect is greater or less than zero to the extent that strong relations are more frequent than would be expected if strength of tie, network size, and sociometric order were independent; positive if strong relations are more frequent and negative if strong relations are less frequent. The top graph presents the tendency for a discussion relation to be close -- especially or equally close -- rather than less close at each level of order and size. The bottom graph presents the tendency

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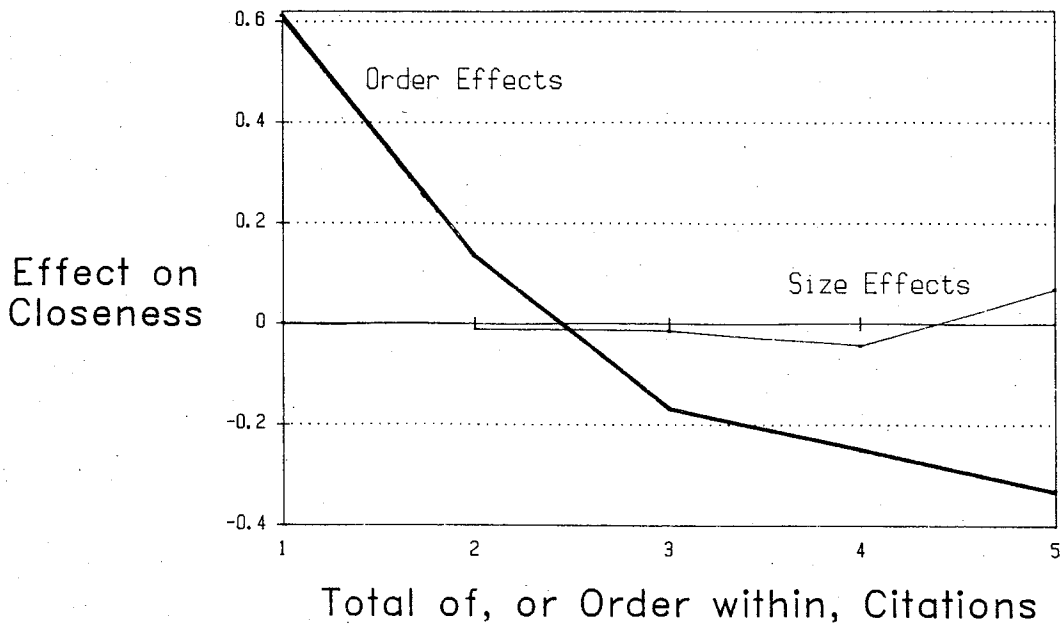
[7]The reported results taken from a three-way tabulation of respondent to discussion partner dyads across citation order (1, 2, 3, 4, 5) by network size (1, 2, 3, 4, 5+) by contact frequency (2 or 3 categories as reported). Structural zeros are created when the order variable is larger than network size and are deleted from the computations (30 for trichotomous frequency, 20 for dichotomous frequency). Note that routine statistical tests here define the upper limit of statistical significance (see footnote 6). The 4,471 dyads in this table were elicited from 1,523 respondents citing one or more discussion partners.

[8]The dichotomy between daily contact and less frequent contact is reported here because it will be used when the tabulation is expanded to include additional control variables. The dichotomy is suggested by the loglinear interactions between trichotomous contact frequency and citation order. Net of univariate frequencies, "weekly contact" and "monthly or less contact" are more likely with increasing citation order while "daily contact" is less likely.



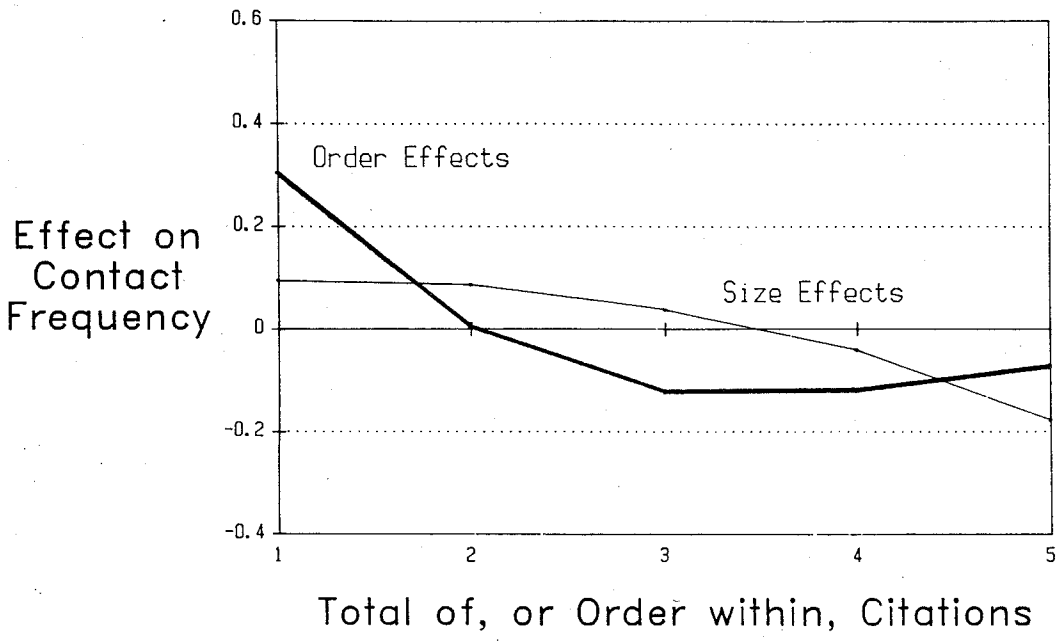




**Figure 3**

**Additive Loglinear Order and Size Effects on Strength of Tie to Respondent**

for the relation to involve daily contact rather than less frequent contact at each level of order and size. Three features of the data presented in figures 1 and 2 are summarized and highlighted in figure 3.[9]

First, network size offers little direct indication of relationship strength if sociometric order is held constant. The tendency for a discussion partner to be close (top graph) is virtually unchanged across networks of two, three, four, and five or more people. The strongest of the effects is in the largest networks and that effect is only 1.1 times as large as its standard error, the ratio being interpretable as a z-score with a normal distribution. The tendency for daily contact with discussion partners (bottom graph) more clearly shows the expected size effects, frequent contact decreasing as network size increases. However, these effects are quite negligible (smaller than their standard errors) except for the effect of large networks. The lack of daily contact in networks of five or more discussion partners is quite noticeable (-3.6 z-score test statistic, $p < .001$).

Second, sociometric order is a relatively detailed indicator of relationship strength in networks of all sizes. The direct association with closeness (top graph) is perfectly monotonic; decreasing from a 9.4 z-score effect indicating the very likely close relation with the person cited first to a -6.8 z-score effect indicating the lack of a close relation with the person cited fifth. The direct effect on contact frequency (bottom graph) is less striking but similar; decreasing from a 6.5 z-score effect indicating daily contact with the person cited first to -2.5 and -1.4 effects indicating less frequent contact with the persons respectively cited fourth and fifth.

Third, the third person cited as a discussion partner is a critical turning point on average. Both closeness and contact frequency have a steep, linear

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[9]In light of the similar effects that order and size have on closeness and frequency, it would seem reasonable to combine all effects in a four-way tabulation and estimate order and size effects on closeness and frequency as joint indicators of relationship strength. Closeness and contact frequency are analyzed separately for two reasons: (a) The virtues of working with a single model are obtained at the cost of greater complexity in the loglinear models and less statistical power because of very small frequencies in several cells. These costs are only worth paying if there is a clear advantage to be gained from analyzing closeness and frequency jointly. (b) The two are independent indicators of relationship strength so there is no advantage to studying effects on combinations of closeness and frequency beyond what is gained by studying effects on each separately. In a four-way tabulation of order, size, closeness and frequency (ignoring null frequencies created by definition when the order variable is larger than network size), the direct interaction between closeness and frequency is negligible (1.5 z-score tendency for close relations to be daily contacts) and deleting all effects involving the interaction of closeness and frequency generates an acceptable chi-square statistic despite probable exaggeration of statistical significance (17.39 chi-square, 10 df, $p \sim .07$).

decline across the first three people cited as discussion partners. The rate of decline slows noticeably across subsequent citations. Closeness continues, slowly, to decline with the fourth and fifth persons named, but the probability of daily contact with the fourth and fifth persons is virtually identical to the probability of daily contact with the person named third.

## BIAS TOWARD SPECIFIC KINDS OF RELATIONS

Certain kinds of relations tend to be associated with stronger relationships than other kinds of relations. For example, kinship creates stronger ties between people than working together. Given the association between citation order and relationship strength, certain kinds of relations can be expected to appear early in a respondent's list of sociometric citations while other kinds of relations appear late. To continue the example, kin should be cited before co-workers.[10] Beyond this natural association between relation content and citation order, a sociometric name generator can be said to carry a content bias if associations with a specific kind of relation persist even after relationship strength is held constant. A narrowly defined name generator should be biased toward the kind of relationship it purports to elicit. A general purpose name generator is likely to carry some mixture of biases depending on the study population in which it is applied. The GSS discussion partner name generator carries specific kinship, sex homophily and co-worker biases when applied to a representative sample of Americans.

### Kinship

Kinship is broken down into five categories in the GSS network data. A discussion partner can be the respondent's (1) spouse, (2) mother or father, (3) brother or sister, (4) son or daughter, or (5) other family member. Four points summarize kinship bias in the GSS data.

First, citation order is associated much more strongly with relationship strength than it is with kinship. Table 1 presents chi-square statistics for the null hypothesis that kinship is independent of citation order (columns labeled

[10]This is in fact true of the GSS data. In a two-way tabulation of kinship by citation order, the tendency for relatives to be cited declines across citation order as indicated by the following z-score loglinear effects; 6.84 for the first cited, and -.95, -1.82, and -1.42 for the second, fourth and fifth cited (the third citation being used as an arbitrary reference for evaluating effects at the other citation positions). In a tabulation of co-worker by citation order, the reverse is true. Citations to co-workers were unlikely to be first and likely to be fourth or fifth (z-score loglinear effects of -3.65, .54, 1.08, and 1.92 for positions one, two, four and five in citation order).

## Table 1

## Order Effects and Kinship Bias

| | NO CONTENT EFFECT | | NO ORDER EFFECT | |
|---|---|---|---|---|
| | Closeness | Frequency | Closeness | Frequency |
| All Kin | 14.45 | 81.20* | 283.29* | 257.73* |
| Spouse | 338.28* | 309.08* | 198.61* | 79.78* |
| Other Kin | 27.22* | 4.37 | 216.57* | 73.89* |
| Parent | 10.82 | 11.74 | 321.51* | 230.03* |
| Sibling | 29.31* | 7.55 | 331.45* | 216.88* |
| Child | 45.99* | 27.40* | 342.31* | 232.35* |
| Other Family | 29.20* | 22.52 | 324.14* | 225.62* |

NOTE -- Other kin are all relatives except spouse. Chi-square statistics with less than a .001 probability are marked with an asterisk. Note that these test statistics define the upper limit of statistical significance (see footnote 6 to the text). Likelihood ratio chi-square statistics are presented in each row first for the null hypothesis that the row kind of kinship is independent of citation order when relation strength is held constant and second for the null hypothesis that relation strength is independent of citation order when kinship is held constant. All of the statistics except for spouse have 8 degrees of freedom. The statistics for spouse have 6 degrees of freedom with closeness and 4 with contact frequency (see footnote 12 to the text). Results are taken from the three-way tabulation of discussion relations across citation order (1 2 3 4 5), kinship (yes, no), and relation strength (dichotomous closeness or contact frequency).

"No Kinship Effect") and the hypothesis that relation strength is independent of citation order (columns labeled "No Order Effect"). Note in the table that the second hypothesis is rejected consistently and strongly relative to the first. The chi-square statistics in columns three and four are 20 to 40 times the magnitude of their degrees of freedom. Moreover, with the exception of a strong spouse bias, the chi-square statistics in the third and fourth columns are 3 to 20 times the magnitude of corresponding statistics in columns one and two.

Second, there is kinship bias in citing discussion partners. Spouses stand apart from other kin in the severity with which the independence hypothesis is rejected.[11] Chi-square statistics on spouse bias are more than 50 times the magnitude of their degrees of freedom in the second row of columns one and two in table 1.[12] The results on other kin are less striking. There is a discernible closeness effect. Looking down the first column, note that siblings, children, other family, and non-spouse kin collectively have a nonrandom association with citation order above and beyond the association that can be attributed to their close relations with respondents.[13] Children and relatives beyond the nuclear family also show such an effect above and beyond the frequency of their contact with respondents. However, the category of all kinship excluding spouse has no direct association with citation order when the direct effects of contact frequency on citation order are held constant (4.37 chi-square, 6 df, $p \sim .82$).

Third, the kinship bias only concerns the first person cited as a discussion partner. This is illustrated in figure 4 and documented in table 2. The spouse effects in figure 4 are taken from the three-way tabulation of spouse (yes, no) by citation order (1, 2, 3, 4) by closeness (close, less close) in which independence was tested for row two of table 1. Naturally, spouses have

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[11]Spouses include wives and husbands as well as spouse surrogates. The "spouse" option on the GSS show card reads as follows: "spouse -- your wife, or husband, or a person with whom you are living as if married."

[12]Spouse effects are so strong that the full range of the citation order variable cannot be used to test effects. There are less close, but no especially or equally close, spouses cited fifth. There are no daily contact spouses or spouse surrogates listed fourth or fifth. Therefore the fourth and fifth categories of citation order have been combined in studying closeness effects with spouses and the third, fourth and fifth categories have been combined in studying contact frequency effects with spouses.

[13]This difference between spouses and other kin is also clear in an analysis of kinds of relationships elicited by the GSS network items. Spouses tend to fall on the extreme of a closeness dimension, clustered together with especially close relations and contrasted with casual relations such as neighbor. Other kin cluster together without any other kinds of relations and contrast with recent, co-worker relationships (Burt, 1985, esp. figure 1).

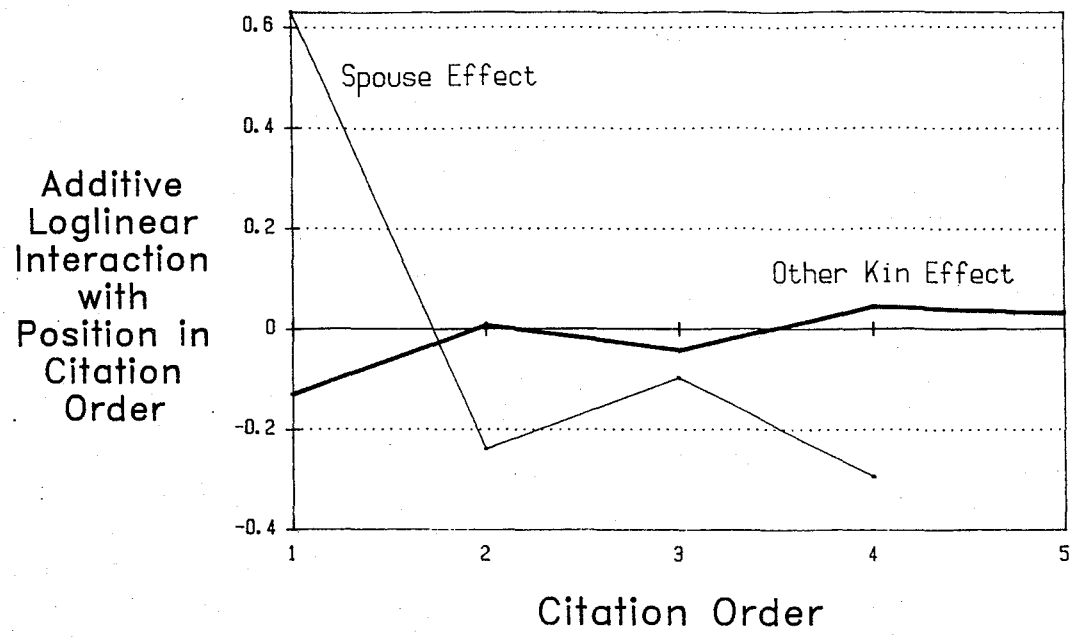


**Figure 4**

**Kinship Bias with Closeness Held Constant**

## Table 2

## Lack of Kinship Bias Past the First Citation

| | CLOSENESS | FREQUENCY |
|---|---|---|
| All Kin | 5.92 | 1.78 |
| Spouse | 5.35 | 6.54 |
| Other Kin | 6.69 | 1.33 |
| Parent | 4.38 | 6.79 |
| Sibling | 6.67 | 1.60 |
| Child | 4.37 | 3.31 |
| Other Family | 5.07 | 2.79 |

NOTE -- Likelihood ratio chi-square statistics are presented in each row for the null hypothesis that the row kind of kinship is independent of citation order given relation strength (closeness or contact frequency). Note that these test statistics define the upper limit of statistical significance (see footnote 6 to the text). All of the statistics except for spouse have 6 degrees of freedom. The statistics for spouse have 4 degrees of freedom with closeness and 2 with contact frequency (see footnote 12 to the text). Results are taken from the three-way tabulations defined in table 1 except that here first citations are deleted from the tabulations before estimating effects.

strong relations with respondents (8.0 z-score in the three-way tabulation for the interaction between spouse and closeness). Above and beyond the tendency illustrated in figure 3 for close discussion partners to be cited early, there is a tendency illustrated in figure 4 for spouses to be cited first. The additive loglinear interaction effect for the tendency of spouses to be cited first is .630 in figure 4 (6.1 z-score). Spouses have no significant tendency to be present or absent in the second or third citation positions. Just the opposite is true of other kin. Parents, siblings, children and other family tend not to have been cited first (-.130 effect in figure 4, -2.8 z-score). They have no significant tendency to be present or absent in each of the subsequent citation positions.

The results in table 2 show that kinship bias is confined to the first citation. The chi-square statistics in table 2 test the independence of kinship and citation order when the first citation is ignored. Compare these results to the first two columns of table 1. Notice that every one of the significant effects in table 1 is eliminated in table 2. In other words, all kinship bias in the GSS network data occurs with respondents deciding who to cite first -- spouses tending to be cited first and other relatives tending not to be cited first.

Fourth, and finally, the observed kinship bias is independent of socioeconomic differences among respondents. Taking education as an indicator of socioeconomic status, the tendency for respondents of lower socioeconomic status to rely more heavily on kinship for discussion relations is illustrated in figure 5. Additive loglinear effects in the figure indicate the tendency for spouses and other kin to be cited by respondents at seven levels of education. The tendency for respondents to cite spouses as discussion partners does not vary systematically or significantly across education. The spouse line vacillates above and below zero in figure 5. The hypothesis that citing spouse is independent of education level cannot be rejected (8.49 chi-square, 6 df, $p \sim .20$). In contrast, the tendency to cite other kinds of kin as discussion partners is strongly associated with education. The independence hypothesis is clearly rejected (123.69 chi-square, 6 df, $p < .001$). The effects in figure 5 decline with education -- positive for respondents with a high school education or less and negative for respondents with more than a high school education. These tendencies are especially strong among respondents who did not graduate from high school and respondents educated beyond the Bachelor's degree.

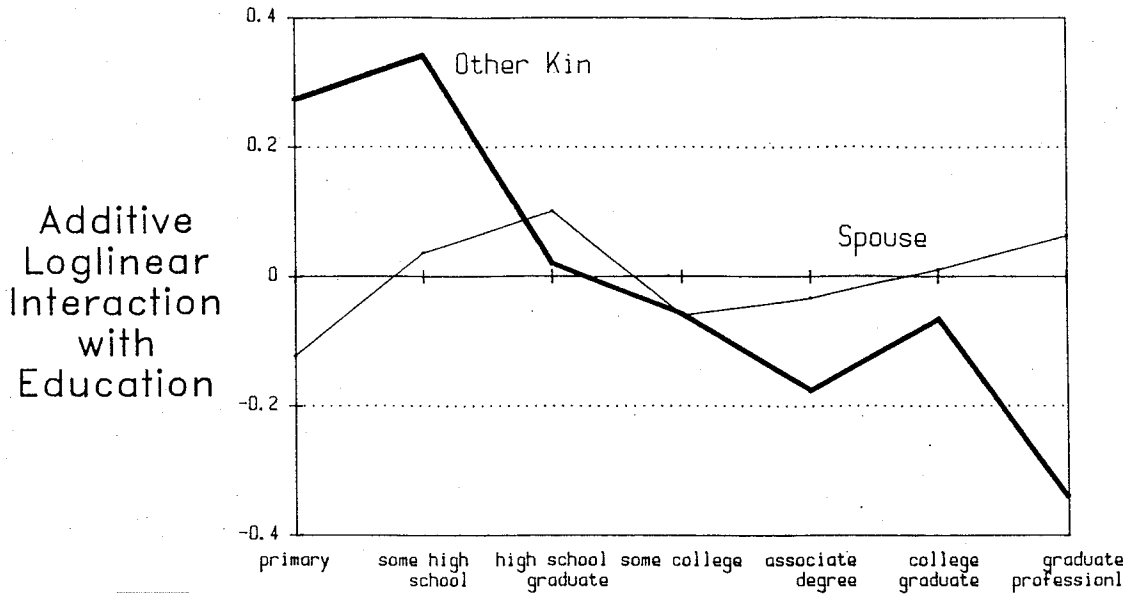


**Figure 5**

**Tendencies toward Kin Discussion Partners across Levels of Respondent Education**

Nevertheless, there is no difference in kinship bias for well and poorly educated respondents. In a three-way tabulation of discussion partners named by respondents with a high school education or less across citation order by closeness by kinship (other than spouse), there is a strong tendency for close relations with kin (8.4 z-score) and the same bias of other kin documented in table 1 and illustrated in figure 4 (generating a 17.60 chi-square statistic for low education respondents, $p < .001$). Kin other than spouses tend not to be cited first (-2.8 z-score). The same is true of respondents educated beyond high school. They tend to have close relations with non-spouse kin (10.6 z-score) and a tendency not to cite these relatives first in their list of discussion partners (17.14 chi-square statistic, $p < .001$ and a -1.6 z-score for first citation). For both levels of education, there is no kinship bias net of the direct effect of contact frequency on citation order.

**Homophily**

The association between social interaction and attribute homophily is well documented in empirical research; social relations tend to develop between people who share important attributes such as age, race, education, occupation, sex, and so on (e.g., Laumann, 1966, 1973:83ff; Verbrugge, 1977; Fischer, 1982:179ff). Verbrugge's analysis is especially relevant here. She finds stronger evidence of homophily in the first cited relationship than she finds in second and third cited relationships. Extending these results to the national sampling frame and holding relation strength constant, I wish to assess the tendency for respondents to acknowledge relations with persons like themselves before they cite relations with people different from themselves.

Table 3 presents chi-square statistics for the hypothesis that attribute homophily in the GSS data is independent of citation order ("No Homophily Effect" columns) and the hypothesis that relation strength is independent of citation order ("No Order Effect" columns). Three points summarize attribute homophily bias in the GSS data.

The first point is that citation order is much more strongly associated with relationship strength than it is with attribute homophily. The chi-square statistics in columns three and four of table 3 are 9 to 41 times the magnitude of their degrees of freedom. Moreover, they are 3 to 25 times the magnitude of corresponding chi-square statistics in the first two columns.

## Table 3

## Order Effects and Attribute Homophily Bias

| | NO CONTENT EFFECT | | NO ORDER EFFECT | |
|---|---|---|---|---|
| | Closeness | Frequency | Closeness | Frequency |
| Same Race | 2.34 | 7.35 | 317.73* | 232.24* |
| Same Education | 8.51 | 4.93 | 323.13* | 232.74* |
| Same Religion | 13.08 | 17.84 | 303.32* | 248.49* |
| All Kin Deleted | 5.67 | 7.58 | 154.04* | 46.26* |
| Same Age | 57.65* | 50.18* | 328.49* | 232.77* |
| Spouse Deleted | 9.78 | 6.23 | 190.46* | 72.41* |
| Same Sex | 69.41* | 103.17* | 306.66* | 247.70* |
| Spouse Deleted | 20.78 | 18.38 | 195.86* | 72.33* |

NOTE -- Chi-square statistics with less than a .001 probability are marked with an asterisk. Note that these test statistics define the upper limit of statistical significance (see footnote 6 to the text). Likelihood ratio chi-square statistics are presented in each row first for the null hypothesis that homophily on the attribute in the row is independent of citation order when relation strength is held constant and second for the null hypothesis that relation strength is independent of citation order when attribute homophily is held constant. All of the statistics have 8 degrees of freedom. Results are taken from the three-way tabulation of discussion relations across citation order (1 2 3 4 5), attribute homophily (yes or no, with attribute categories defined in the text), and relation strength (dichotomous closeness or contact frequency).

Second, the GSS network data are consistent with past studies in revealing extensive homophily in discussion relations, however, most of that homophily can be attributed to relation strength and kinship. The results in table 3 report homophily bias with relation strength held constant. There are several biases apparent from the first two columns of the table. Respondents tended to select discussion partners of their own religion, age, and sex (same race and same education having no effect net of closeness or contact frequency).[14] However, much of this bias is spurious, created by the tendency for some respondents to turn to relatives for discussion relations.

Religious affiliation is very similar within families so a discussion relation with a relative is likely to create the appearance of religious homophily in discussion relations. In table 3, a discussion relation involves religious homophily when respondent and discussion partner claim the same one of four broad religious affiliations; Protestant, Catholic, Jewish, None. There is some tendency toward religious homophily in discussion relations after relation strength is held constant (13.08 and 17.84 chi-square statistics in the third row of table 3 giving the null hypothesis probabilities of .11 and .02). The fourth row of table 3 shows that this modest tendency toward religious homophily disappears completely in discussion relations beyond the family (for closeness and contact frequency respectively, chi-square statistics of 5.67 and 7.58, 8 df, probabilities of .68 and .48).

There is much stronger evidence of age homophily bias in the GSS data, but people tend to marry persons roughly their own age and have brothers or sisters roughly their own age so discussion relations with spouses and siblings are likely to create the appearance of age homophily. For the purposes here, I have coded age homophily in a discussion relation when respondent and

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[14]Racial and educational homophily are defined with the GSS data available on respondents and discussion partners. Respondents were asked to identify each discussion partner as asian, black, hispanic, or white. The extended ethnicity data on respondents were then used to create the same four distinctions among respondents. Black respondents are identified directly. Asian respondents are those citing Chinese, Philippine, or Japanese ancestry. These are the respondents most likely to label their discussion partners asian. Hispanic respondents are those citing Mexican, Puerto Rican, Spanish and other Spanish ancestry. These are the respondents most likely to label their discussion partners hispanic. All other respondents not coded as "black" or "other" on the GSS race variable are coded as whites. In table 3, a discussion relation has race homophily when respondent and discussion partner fall into the same one of these four categories. Respondents were asked to identify each discussion partner's level of education within eight categories, seven of which are distinguished in figure 5. For the purposes of identifying educational homophily, incomplete high school educations were combined with lesser educations. In table 3, a discussion relation has education homophily when respondent and discussion partner fall into the same educational level; less than high school, high school graduate, some college, Associate degree, Bachelor degree, graduate or professional school.

discussion partner are within five years of one another's age. This is an arbitrary range creating a ten year interval around the respondent's age for age homophily. Holding closeness or contact frequency constant, there is a strong age bias in citing discussion partners (respective chi-square statistics of 57.65 and 50.18 in the fifth row of table 3). However, just putting spouses to one side is sufficient to completely eliminate this bias. The sixth row of table 3 reports the acceptability of the hypothesis that age homophily in relations beyond the spouse is independent of citation order once closeness or contact frequency is held constant (9.78 and 6.23 chi-square statistics in the sixth row of table 3 respectively giving the null hypothesis .28 and .62 probabilities of being true).

Third, and finally, there is sex homophily bias in the data. Respondents tended to cite discussion partners of their own sex before they cited members of the opposite sex. At first glance this is not true. The biases responsible for the large chi-square statistics in the first and second columns of row seven in table 3 show a curvilinear association between sex homophily and citation order; members of the same sex tend to be absent among the the first and the fifth persons cited. However, spouses tend to be members of the opposite sex, tend to be cited first, and so create the absence of same sex discussion partners among the first people cited. Deleting discussion relations with spouses does not eliminate the evidence of sex bias (20.78 and 18.38 chi-square statistics in the eighth row of table 3 give the null hypothesis a .01 probability of being true), but does clarify the nature of sex bias in discussion relations.[15]

The bias is illustrated in figure 6. In closeness and contact frequency, respondents tended to begin citing members of their own sex as discussion partners before shifting to members of the opposite sex. The tendency to cite

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[15]Differences between men and women in the number of discussion partners they cite might be viewed as the source of sex bias. The significant shift to opposite sex occurs in the fifth position and in the survey most representative of Americans conducted prior to the GSS, Fischer (1982:41, 383-384) reports that women cited slightly more people with whom they discussed personal matters. Network size is not responsible for the sex homophily bias in the GSS data. First, network size is independent of respondent sex (7.03 chi-square, 5 df, $p \sim .22$). Second, holding network size constant does not eliminate the significant chi-square statistics in table 3 indicating sex bias. The hypothesis that sex homophily is independent of citation order is unacceptable with closeness and network size held constant (61.70 chi-square, 18 df, $p < .001$) and it is unacceptable with contact frequency and network size held constant (87.27 chi-square, 18 df, $p < .001$). These results are obtained in a four-way tabulation of non-spouse discussion relations across citation order (1, 2, 3, 4, 5), sex homophily (yes, no), relation strength (dichotomous closeness or contact frequency), and network size (2, 3, 4, 5 for closeness; 1, 2, 3, 4, 5 for frequency). Structural zeros are deleted from the computations (24 created when citation order is larger than network size in the closeness tabulation and 40 similarly created in the frequency tabulation).

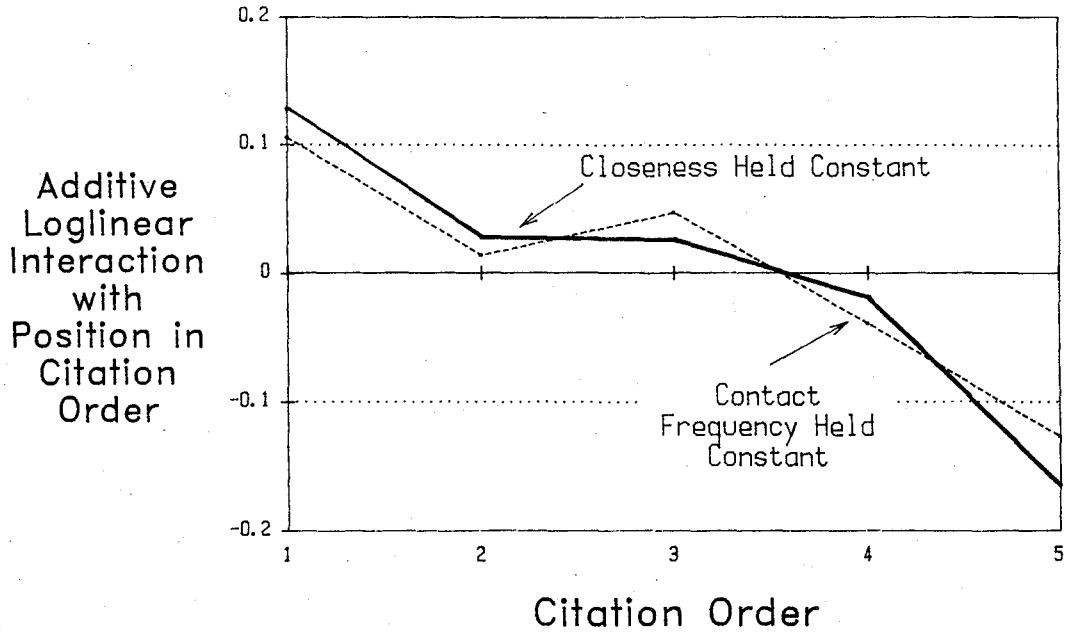



**Figure 6**

**Tendencies toward Sex Homophily (spouses excluded)**

same sex discussion partners first is strong with closeness or contact frequency held constant (2.7 and 3.0 z-scores for the first position effects in figure 6). The tendency to cite opposite sex discussion partners last is strong under the same controls (-3.4 and -2.5 z-scores for the fifth position effects in figure 6).

The overall bias toward sex homophily illustrated in figure 6 emerges differently for men and women. The differences are indicated in table 4. Spouses are again deleted from the computations. Table 4 presents z-score loglinear effects expressing tendencies toward sex homophily in strong relations and chi-square statistics for the hypothesis that sex homophily is independent of citation order.

For women, sex bias is expressed in the selection of people with whom they spend time. Women have no significant tendency to feel closer to women than men and there is no sex bias for women when the closeness of relationships is held constant (z-score and chi-square test statistics are negligible in table 4 for women under closeness). There is a strong sex bias in their most frequent discussion relations. Daily contacts tend to be women (3.76 z-score) and citation order is contingent on sex homophily when contact frequency is held constant (21.99 chi-square, 8 df, $p \sim .005$). The sex bias is weak among single women, but strong among married women. In general, women tend to name another woman as their first discussion partner (2.3 z-score with frequency held constant). More specifically, married women tend to name a woman as their first discussion partner and their fifth tends not to be a woman (2.1 and -2.4 z-scores respectively with frequency held constant).

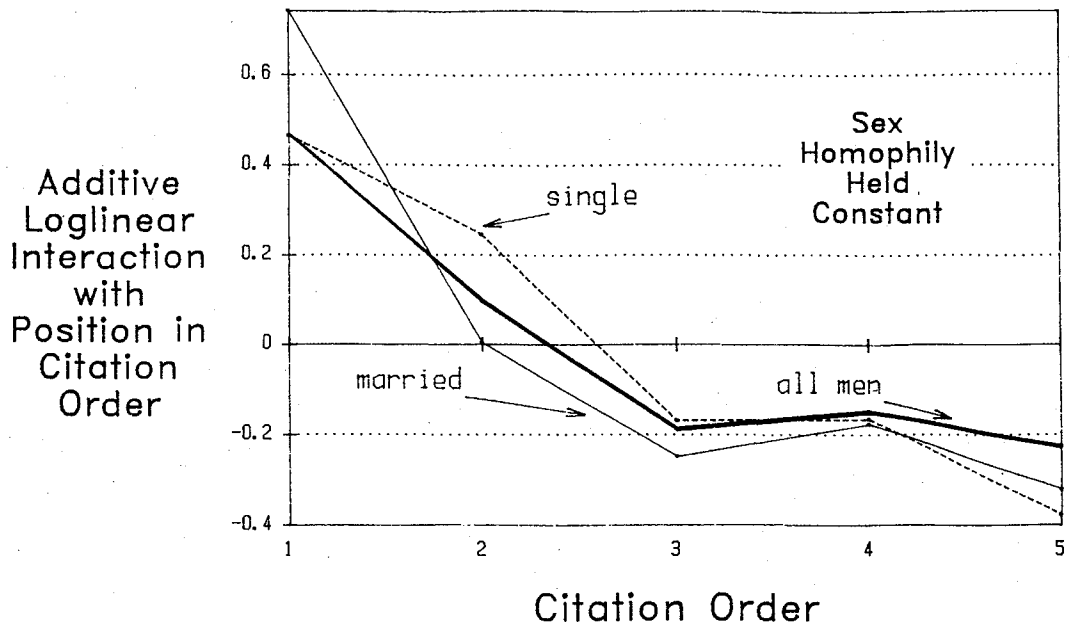
For men, sex bias is different and less obvious than it is for women. Men express sex bias in the selection of people to whom they feel close. Citation order is contingent on sex homophily for men in table 4 when closeness is held constant (chi-square statistics of 24.00 to 30.00, 8 df, $p < .001$). The sex bias is complex because all men, single and married, claim that they are closer to women than men and spend more time with women. Sex homophily is negatively associated with closeness for men in table 4 (z-scores of -4.2 to -2.5) and negatively associated with frequency for men overall (-2.63 z-score). Recall that these results cannot be attributed to spouses because spouses are not included in the table 4 results. Further, the negative association between sex homophily and closeness is not created by the control for citation order in the three-way table because the association is also

## Table 4

## Order Effects and Sex Homophily Bias among Men versus Women

| | CLOSENESS | | FREQUENCY | |
|---|---|---|---|---|
| | Z-Score | Chi-Square | Z-Score | Chi-Square |
| WOMEN | | | | |
| All | 1.54 | 15.29 | 3.76 | 21.99* |
| Single | 0.41 | 13.23 | 1.24 | 13.77 |
| Married | 0.37 | 14.13 | 2.55 | 19.76* |
| MEN | | | | |
| All | -4.17 | 24.00* | -2.63 | 13.50 |
| Single | -3.83 | 30.00* | -1.19 | 24.49* |
| Married | -2.47 | 25.67* | 0.14 | 14.06 |

NOTE -- Chi-square statistics with less than a .01 probability are marked with an asterisk. Note that these test statistics define the upper limit of statistical significance (see footnote 6 to the text). Z-score test statistics are presented in each row for the null hypothesis that relation strength is independent of sex homophily. Likelihood ratio chi-square statistics are presented in each row for the null hypothesis that sex homophily is independent of citation order when relation strength is held constant. The chi-square statistics have 8 degrees of freedom. Results are taken from the three-way tabulation of discussion relations across citation order (1 2 3 4 5), sex homophily (yes, no), and relation strength (dichotomous closeness or contact frequency).



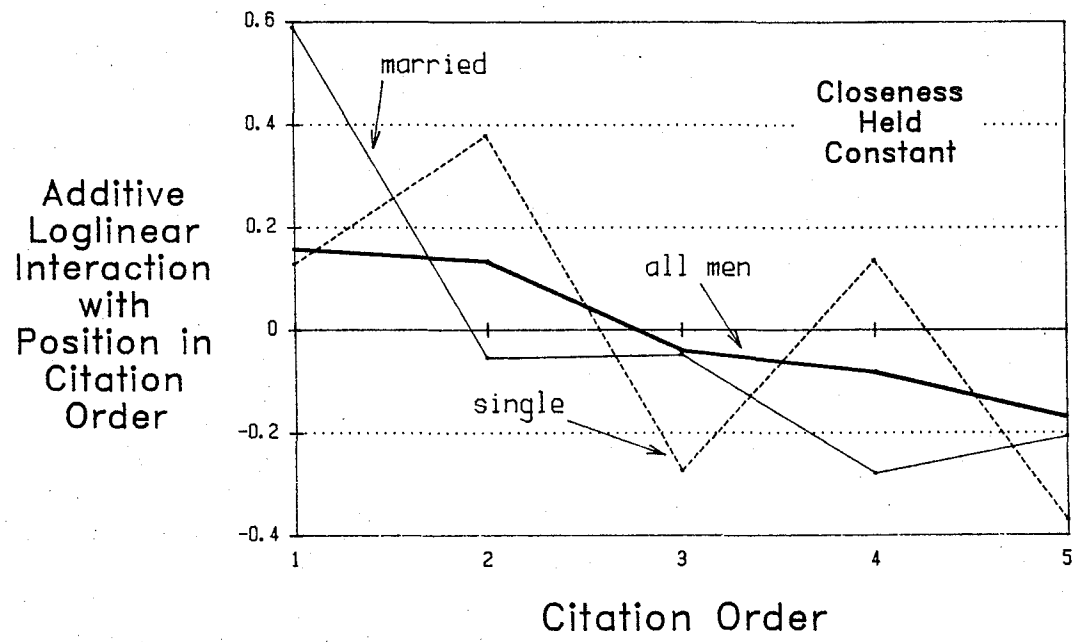




**Figure 7**

**Sex Homophily Bias among Men versus Women**

negative in a two-way tabulation of sex homophily by dichotomous closeness (-3.5 z-score).

Figure 7 presents graphs of sex homophily and order effects on closeness among men. These results are taken from the closeness tabulations for men reported in table 4. The graph at the top of figure 7 shows that men overall, and married men considered separately from single men, order their discussion relations by closeness; their first named is most likely to be close and their last named is least likely to be close. Note once again the steep, linear decline across the first three citations and the much slower decline across the last two citations. The graph at the bottom of figure 7 shows that all men, and especially married men, tend to name other men as discussion partners before they name women. This tendency is less clear for single men, but it is still true that single men tend to name men as their first and second citations (1.1 and 3.0 z-scores) while tending not to name men as their fifth citations (-2.6 z-score). In sum, sex bias is a mixed message from male respondents. Overtly, they claimed closer relations with women than men. Less obviously, they listed their important discussion partners in descending order of closeness and began their list with the names of other men.

**Other Roles**

Data on five roles other than kinship are provided in the GSS data; co-worker, co-member of a group, neighbor, friend, and professional advisor or consultant. Table 5 presents chi-square statistics for the hypothesis that the appearance of these roles in a discussion relation is independent of citation order ("No Content Effect" columns) and the hypothesis that relation strength is independent of citation order ("No Order Effect" columns). Four points summarize bias toward these roles.

First, once again, citation order is much more strongly associated with relation strength than it is with relation content. The chi-square statistics in columns three and four of table 5 are 4.5 to 40 times the magnitude of their degrees of freedom and 2 to 76 times the magnitude of corresponding statistics in the first two columns.

Second, there is no evidence of bias in discussion relations outside the job. The hypothesis of content being independent of citation order when relation strength is held constant cannot be rejected. It cannot be rejected for

discussion relations generally nor for the specific relations extending beyond the respondent's family.

Third, the only exception is the co-worker bias in table 5 that appears when frequency is held constant. It appears across all relations (58.93 chi-square, 8 df, $p < .001$) and in relations beyond the respondent's family (28.35 chi-square, 8 df, $p < .001$).

Figure 8 shows how the tendency to cite nonkin co-worker complements the kinship bias illustrated in figure 4. There is a strong tendency for discussion relations with co-workers to be less close than relations with other kinds of people (-4.95 z-score with citation order held constant), but there is no tendency for co-workers to appear early or late in the citation order when closeness is held constant (11.04 chi-square in table 5, $p \sim .20$). The closeness line in figure 8 is never significantly different from zero (maximum z-score for any bias with closeness held constant is 1.2). In contrast, there is a strong tendency for discussion relations with co-workers to involve daily contact (14.30 z-score with citation order held constant), and a significant tendency for co-workers to be cited late on the list of discussion partners (28.35 chi-square in table 5, $p < .001$). With contact frequency held constant, the tendency for co-workers not to be cited first in figure 8 has a -3.5 z-score test statistic and the tendencies for co-workers to be cited fourth and fifth have 2.2 and 2.6 z-score test statistics. Recall that these results cannot be attributed to a shift from kin to co-workers because discussion relations with kin are excluded from the computations.

Fourth, the co-worker bias is observed across socioeconomic differences between respondents. Using education once again to indicate socioeconomic status, there is a strong association between citing co-workers and socioeconomic standing. Across discussion relations, the hypothesis that citing a co-worker is independent of the seven levels of education in figure 5 is clearly unacceptable (chi-square statistics of 91.12 and 37.56 for all relations and nonkin relations respectively, 6 df, $p < .001$). The principal shift to co-workers begins with college graduates. Co-workers are avoided by respondents with less than a high school education, indifferent to respondents with a high school education, and sought out by respondents with a college education. The additive loglinear effects across all relations indicating the tendency to cite co-workers are -.10 for respondents with a primary school education, -.41 for those with a junior high school education (-6.8 z-score), .00 for some high

## Table 5

## Order Effects and Other Content Biases

| | NO CONTENT EFFECT | | NO ORDER EFFECT | |
|---|---|---|---|---|
| | Closeness | Frequency | Closeness | Frequency |
| Co-Worker | 7.04 | 58.93* | 308.55* | 268.27* |
| Nonkin | 11.04 | 28.35* | 166.05* | 51.84* |
| Co-Member of Group | 18.59 | 16.35 | 321.53* | 226.74* |
| Nonkin | 20.10 | 16.34 | 171.29* | 35.86* |
| Neighbor | 4.54 | 15.31 | 318.56* | 237.48* |
| Nonkin | 11.43 | 17.12 | 165.60* | 39.83* |
| Friend | 4.13 | 6.35 | 316.79* | 227.08* |
| Nonkin | 7.20 | 3.22 | 172.70* | 37.38* |
| Advisor or Consultant | 16.37 | 21.60 | 321.50* | 234.50* |
| Nonkin | 8.58 | 6.06 | 171.85* | 38.24* |

NOTE -- Reading from the GSS show card describing these roles, a co-worker is "someone you work with or usually meet while working," a co-member of a group is "for example, someone who attends your church, or whose children attend the same school as your children, or belongs to the same club, classmate," a neighbor is "someone outside your own household who lives close to you in your neighborhood," a friend is "someone with whom you get together for informal social occasions such as lunch, or dinner, or parties, or drinks, or movies, or visiting one another's home; this includes a boyfriend or a girlfriend," and a professional advisor or consultant is "a trained expert you turn to for advice, for example, a lawyer or a clergyman." Chi-square statistics with less than a .001 probability are marked with an asterisk. These test statistics define the upper limit of statistical significance (see footnote 6 to the text). Likelihood ratio chi-square statistics are presented in each row first for the null hypothesis that the relation content in the row is independent of citation order when relation strength is held constant and second for the hypothesis that relation strength is independent of citation order when relation content is held constant. All of the statistics have 8 degrees of freedom. Results are taken from the three-way tabulation of discussion relations across citation order (1, 2, 3, 4, 5), relation content (dichotomous yes or no for the role in each row), and relation strength (dichotomous closeness or contact frequency).

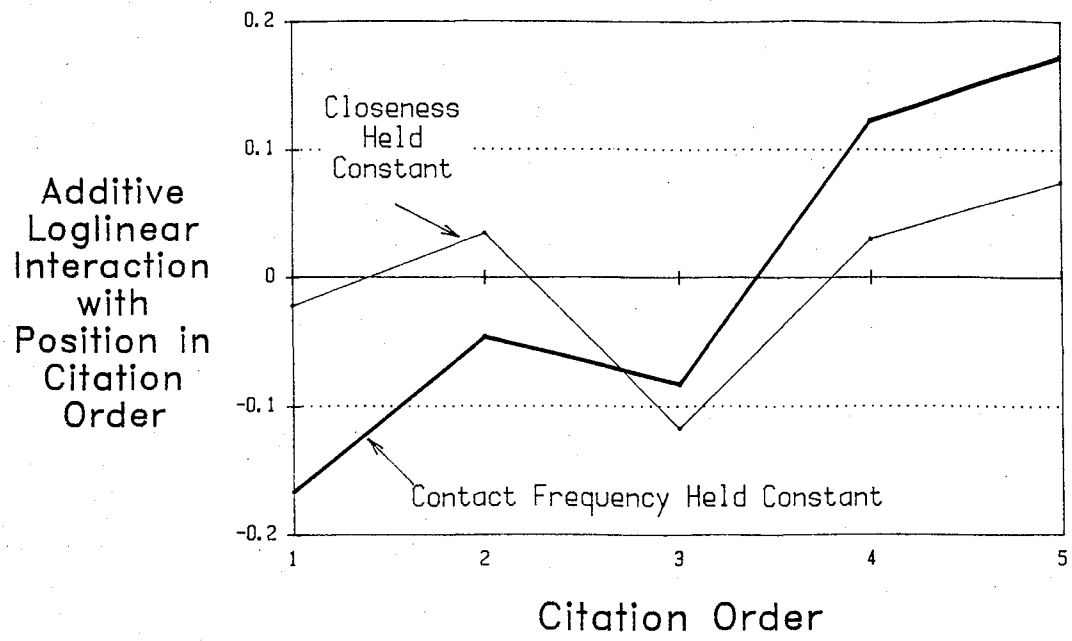



**Figure 8**

**Tendencies toward Co-workers as Nonkin Discussion Partners**

school, .04 for high school graduates, .01 for respondents with some college, .11 for college graduates (2.3 z-score), and .35 for respondents with partial or completed graduate or professional school educations (6.1 z-score). The strong association with education notwithstanding, co-workers tend to be cited as daily nonkin contacts by respondents with educations prone to citing co-workers (7.9 z-score for college graduates and up) and by respondents with educations indifferent or ill disposed to citing coworkers (11.8 z-score for some college and less). More to the point, the high education respondents tend -- as illustrated in figure 8 for all respondents -- to delay citing co-workers until late in their list of nonkin citations (e.g., -2.9 z-score for co-workers appearing as the first citation) and the low education respondents do the same (e.g., -2.0 z-score for co-workers appearing as the first citation). Holding contact frequency constant, the hypothesis that citing co-workers is independent of citation order is unacceptable among respondents with college or higher educations (21.53 chi-square, 8 df, $p < .001$) and among respondents with less than a completed college education (24.93 chi-square, 8 df, $p < .001$).

## SUMMARY

The people identified as important discussion partners in the GSS network data were cited in order of strength of relationship with respondent; the first cited person having the strongest relation, the second having the next strongest, and so on. On average, the third citation is a turning point. There is a steep, linear decline in relationship strength across the first three people cited as discussion partners and a slower, but continuing decline, across the fourth and fifth people cited. I have described order effects on closeness and contact frequency in the context of network size and relation content. There is a kinship bias only in deciding who to name first; spouses tended to be the first discussion partner cited and other kin tended not to be. There is a sex homophily bias across all respondents -- people of one's own sex were cited as discussion partners before members of the opposite sex -- but it emerged differently for men and women. Women, especially married women, expressed sex bias in the people with whom they spent time while men expressed sex bias in the people with whom they felt close. Men claimed closer relations with women than men but in fact listed their important discussion partners in descending order of closeness and began the list with the names of other men. Finally, there is evidence of a co-worker bias in discussion relations beyond

the family; respondents tended to mention co-workers as daily contacts but late in their list of important discussion partners. With the exception of the spouse bias, all evidence of content bias is markedly weaker than the consistent tendency for respondents to list discussion relations in descending order of closeness and contact frequency.

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