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Are respondents more likely to list alters with certain characteristics? Implications for name generator data

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Abstract

Analyses of egocentric networks make the implicit assumption that the list of alters elicited by name generators is a complete list or representative sample of relevant alters. Based on the literature on free recall tasks and the organization of people in memory, I hypothesize that respondents presented with a name generator are more likely to name alters with whom they share stronger ties, alters who are more connected within the network, and alters with whom they interact in more settings. I conduct a survey that presents respondents with the GSS name generator and then prompts them to remember other relevant alters whom they have not yet listed. By comparing the alters elicited before and after prompts I find support for the first two hypotheses. I then go on to compare network-level measures calculated with the alters elicited by the name generator to the same measures calculated with data from all alters. These measures are not well correlated. Furthermore, the degree of underestimation of network size is related to the networks' mean closeness, density, and mean duration of relationships. Higher values on these variables result in more accurate estimation of network size. This suggests that measures of egocentric network properties based on data collected using a single name generator may have high levels of measurement error, possibly resulting in misestimation of how these network properties relate to other variables.

Keywords: Name generator; Forgetting; Egocentric networks; Reliability

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1. Introduction

The collection of egocentric network data has been common, especially in the study of community and social support. For example, Laumann (1966) collected data on personal networks in Detroit to study interpersonal relationships across social categories such as race, religion and occupations; Bott (1971) used personal networks to study family and marital relations; Wellman (1979) used egocentered network data to study social support in an urban setting; and Fischer (1982) studied personal networks in Northern California. More recently egocentric network data have been collected as part of large surveys that are not network-focussed, such as the General Social Survey (Burt, 1984; Marsden, 1987).

The most common method of collecting survey data on egocentered networks is by far the use of *name generators* and *name interpreters* (Marsden, 1990). Name generators enumerate "alters" deemed to lie within a network by asking respondents to list those people with whom they share one or more criterion relations, such as helping with household tasks or discussing work decisions (McCallister and Fischer, 1978), feeling close (Wellman, 1979), discussing important matters (Marsden, 1987), chatting, or visiting (Campbell and Lee, 1991). Once respondents have listed the people with whom they share these criterion relations, individuals listed (alters) are presumed to be the members of respondents' networks.

After the name generator, such interviews proceed to a series of questions (name interpreters) designed to elicit information about the alters, their relationships to the respondent and their relationships with one another. Typically respondents are asked to give demographic characteristics (age, sex, education) of their alters, to state their frequency of contact with alters, and to list those pairs of alters who know one another. Often data from these name interpreters are used to calculate composite measures of the structure of a respondent's personal network. These are measures of network-level properties that are calculated from the alter-level data (Marsden, 1990). Examples include size, density, range, mean age, mean educational level, level of homophily, or mean strength of tie. These network characteristics are then used to predict various outcomes or used as dependent variables to be predicted by characteristics of the respondent.

Analyses of the kind described above rely on the assumption that the data collected through the name generators and name interpreters are accurate and unbiased. However, this assumption has gone largely untested. While the quality of informant data in the study of complete networks has been the subject of considerable investigation,[1] similar studies confirming or calling into question the reliability of informant data for egocentric networks have not been conducted.

The purpose of this paper is to assess the reliability of data collected using name-generators by examining the list of alters that name-generators produce and dis-

[1] For example, early work by Bernard, Killworth, and Sailer raised alarm with the finding that as much as 52% of this data was incorrect in some way and that inaccuracies at the alter level translated into miscalculated measures at the dyadic, triadic, and clique levels (Bernard and Killworth, 1977; Bernard et al., 1979, 1982, 1984; Killworth and Bernard, 1976, 1979). Later extensions and critiques of this work suggested that the state of complete network data is not as grim as BKS originally suggested (Burt, 1983; Freeman et al., 1987; Kashy and Kenny, 1990; Romney and Weller, 1984).

cussing the likely effects of biases in this list on composite measures of personal networks.

2. Forgetting and alter selection

Although analyses of data collected with name-generators make the implicit assumption that respondents list *every* person with whom they share the criterion relation, it is unlikely that the lists of names produced represent a complete enumeration of network members. Research confirms that respondents asked to list all of the people who fit into a given category will rarely list all of the relevant names. Brewer's (2000) review of the literature on forgetting finds that respondents forget between 1% and 90% of the people they are asked to list. Brewer's own research comparing lists produced by respondents asked to list everyone in their academic department (Brewer, 1993), religious community (Brewer and Yang, 1994), or organizational department (Brewer, 1995) to complete membership rosters finds that respondents can recall only 50%, 29%, and 76%, respectively, of the total membership lists of these organizations.

In each of the studies listed above, the people who respondents were asked to recall were not necessarily members of their networks; therefore, it is possible that individuals not listed were unknown to the respondent rather than forgotten. However, research in which respondents are asked to list people with whom they have some sort of relationship is only slightly more encouraging. In Brewers and Webster's (1999) sample of university residents, respondents failed to recall 20% of fellow residents whom they considered to be friends. In another study, 70% of respondents at high risk for HIV infection forgot at least one drug injection partner, with respondents forgetting an average of 25% of their drug injection partners. As one might expect by the more intimate nature of the relationship, sexual partners are less likely than injection partners or friends to be forgotten, but even with this relation 50% of the same sample forgot at least one partner and an average of 14% of sexual partners were forgotten (Brewer et al., 1999a).[2]

This body of research indicates that even when the criterion relation is a close one that a respondent shares with only a small number of people, it is probable that respondents forget to list some alters and that the list of names generated is not a list of all network members but a subset of network members (Pool and Kochen, 1978; Hammer, 1984). In spite of the high levels of forgetting, available evidence indicates that the number of alters recalled is sufficiently correlated with the total number of alters to ensure that the number of names elicited is a reliable measure of the total number of names (Brewer and Webster, 1999; Brewer, 2000). However, even if size estimates are reliable, it is still possible that the respondents' failure to enumerate all alters may result in mis-estimation of other composite measures of network properties.

The issue of how respondents' recall of their alters affects measures of their network properties is essentially a question of who is likely to be included in the subset listed and

[2] Note that measures of percent forgotten for this study were based on the number of people that respondents remembered later. Since there may have been forgotten alters who were not recalled in response to prompts or in subsequent interviews, the levels of forgetting listed here may be underestimated.

who is likely to be forgotten. If some properties of alters make them more or less likely to be elicited, then network measures that are composites of those properties will be biased.

3. Name generators and the reproduction of cognitive structures

Thus far I have shown that there is ample evidence to indicate that networks provided by respondents are subsets and not censuses of alters. Furthermore, because biased selection of alters may compromise the reliability of density and other composite measures of network structure (Marsden, 1993), it is important to understand how respondents recall alters from their networks and which alters are likely or unlikely to be elicited. Ideally, if respondents do not list all of the relevant alters, they would sample and name alters randomly. However, research on the organization and retrieval of persons in memory suggests that random sampling of alters is not likely.

To understand why respondents name some alters and not others, I conceptualize name generators as free recall tasks. Free recall methods ask respondents to name all the items they can think of that fall into a given category. Such tasks are known to reproduce the structure that the recalled items take in memory (Katz, 1976, cited in Freeman et al., 1987). The structure of memory is revealed in three ways: some items are more likely to be recalled than others, some are recalled earlier than others (serial order bias), and some items are likely to be recalled together (associative bias).

Name-generators are free-recall questions in which respondents are asked to list all of the people with whom they share a given relationship, and therefore I expect that the list of names elicited by name generators will be influenced by the ways in which respondents organize their alters in memory. In the next section, I draw on the literature on the organization of people in memory to hypothesize that the probability of particular alters being elicited by a name generator is affected by (a) the strength of respondents’ ties with that alter (b) the alter’s embededness in the network of other alters and (c) the alter’s position in the network of contexts in which the respondent socializes.

4. Hypotheses

4.1. *Strength of ties to the alter*

The literature suggests several reasons why strong ties may be more easily recalled. First, in general, people who are seen by the respondent as more typical of the category in question tend to be named earlier than those people seen as atypical (Freeman et al., 1987). It is plausible that respondents’ prototypes of network members are composites of those alters with whom they interact more frequently or to whom they feel closest. Second, respondents have more elaborate cognitive structures organizing their memories of people with whom they have more experience, and memories stored in more complex cognitive structures are more easily recalled (Freeman et al., 1987). Finally, strong ties are likely to be more densely connected to the respondents’ other ties (Granovetter, 1973) and more densely connected alters are less likely to be forgotten (see below).

The empirical evidence bears out these conjectures. Respondents in whole network studies are more likely to remember stronger ties (Brewer, 1995, 2000; Brewer and Yang, 1994[3]), or those alters with whom they had frequent contact, knew well, or had seen recently (Hammer, 1984). This may in part explain why the literature on forgetting reviewed above shows higher levels of forgetting for weak affiliation-based ties (such as belonging to the same religious fellowship) than for stronger friendship and sexual ties.

Based on this evidence, I hypothesize that

H1. A relevant alter's name is more likely to be elicited by a name generator if that alter shares a stronger tie with the respondent.

The measures that I use of tie strength, described in more detail below, are the number of types of relationships the alter shares with the respondent (multiplexity), the respondent's report of closeness, and the duration of the respondent's relationship with the alter.

4.2. Degree centrality

Respondents have consistently been shown to cluster alters based on their social proximity to one another; alters who are connected to one another are more likely to be named together. This result has been replicated with respondents naming members of a religious community (Brewer and Yang, 1994), employees in an organizational department (Brewer, 1995), friends in a residence hall (Brewer and Webster, 1999) and sexual and drug injection partners (Brewer et al., 1999b). Respondents have also been shown to name alters in temporal bursts that correspond to the contexts in which they interact with alters (Bond and Sedikides, 1988). It is likely that alters who interact with respondents in the same context know one another and so this may result in clustering by social proximity of alters. Alters who were forgotten have been shown to be peripheral both in objective terms (Brewer and Webster, 1999) and in the perception of the respondent (Brewer and Yang, 1994).

H2. A relevant alter's name is more likely to be elicited by a name generator if that alter is connected to a greater number of other alters in the network.

4.3. Embeddedness in respondent's social contexts

Respondents cluster their listing of alters based on the contexts in which they interact (Bond and Sedikides, 1988). It is plausible, then, that alters who are less embedded in these contexts are less likely to be included in a cluster of context-based names. Those who

[3] Brewer (1995) and Brewer and Yang (1994) find that weaker ties are likely to be named *later* than other ties, not that they are less likely to be named. However, I feel confident in using this evidence in formulating my hypotheses because I assume that for each respondent there exists a finite number of alters with whom the respondent shares the criterion relation. Given enough time, each respondent could list all of these alters, but the ordering of the names on the list would be subject to the association and serial order biases described above. In actual interview situations, respondents do not have enough time to remember all relevant alters and the interviewer hears only the names of the first *n* alters. The alters who are likely to be forgotten are the ones who are likely to be named later if all alters are listed.

participate in many contexts are more likely to have one of their contexts recalled and all the names from that context—including their own—named.

It is not clear how respondents select contexts from which to name alters. However, it is possible that upon naming a particular alter, the respondent is reminded of the context in which he or she interacts with that alter and then proceeds to name other alters from that same context. If this is the case, then alters who are more embedded by virtue of sharing group memberships with a greater number of other alters (even if belonging to a smaller number of groups) should have a greater likelihood of having a context in which they participate recalled. Based on these conjectures:

H3. A relevant alter's name is more likely to be elicited by a name generator if that alter is more embedded in the groups in which the respondent interacts with others.

Group embeddedness can take the form of participation in a greater number of groups, participation in a greater proportion of the respondent's groups, or sharing group memberships with a greater number of other alters.

5. Survey, sample, and data

To test these hypotheses, I conducted a survey which first uses a standard name generator and then administers a series of prompts for additional alters with whom respondents shared the criterion relation. I recruited respondents for a web-administered survey using a flyer posted on the 'Subjects Wanted' bulletin board in the social sciences building of a university. The computer-assisted format allowed each respondent's survey to be customized so that respondents were presented only with relevant questions and so that their responses could be inserted into subsequent questions. Respondents who volunteered were given the web address for the survey and a respondent ID number that they needed to enter in order to be allowed access to the survey. Respondents were each paid $5 US for their participation.

After being asked for their year of birth, sex and race, respondents were presented with the name generator developed for the 1985 General Social Survey:

"From time to time, most people discuss important matters with other people. Looking back of the last six months, who are the people with whom you discussed matters important to you. Just tell me their names or initials" (Marsden, 1987, p.123).

I chose this name generator because the GSS data drawn from this question have been widely analyzed and because this question has since been used by other researchers (see Bailey and Marsden, 1999 for a more complete discussion). Furthermore, this name-generator elicits alters for what should be a relatively small network (Burt, 1984), making the task of responding to name interpreters for all alters cited less onerous for the respondent. Finally, the brevity of this question means that even with the addition of prompts, surveys were still relatively short.

To obtain a partial list of the alters whom respondents failed to name when responding to the name-generator, I draw on research suggesting that respondents store people in memory based on the contexts in which they interact with them. If respondents are naming alters whom they know from certain contexts, then they are likely to be neglecting to name those they know from others. By prompting respondents to think of more of the contexts in which they interact with people and encouraging them to name relevant people from those contexts, it is possible to find network members who were omitted from the original list.

To identify potential un-recalled contexts, the second page of the survey elicited a list of groups in which the respondent participated. Each respondent was presented with a list of categories of activities or groups and asked to list any that they participated in within those categories.[4] The final category asked for "other voluntary groups" to encourage respondents to list groups that did not fit into any of the previous categories. Finally, the survey asked respondents to list all the jobs they had held in the past 2 years.

Once respondents had submitted their list of voluntary groups and jobs, the survey program provided these instructions:

"In the following set of questions you will be asked to think about the people who you know from groups or activities that you participate in".

"You may have discussed important matters with some of these people and forgotten to list them earlier. It is very important that you provide a *complete* list of people with whom you have discussed important matters. Therefore, please think carefully about the people who fit into each of these categories. If you have discussed important matters with any of these people and not yet listed them, please list their first names in the boxes provided. Use an initial if two people share the same name. You need not re-enter the names of people you have already listed".

Respondents were then presented with the list of groups they had provided, with space below the name of each group in which to enter the names of alters. In addition to the specific groups that each respondent listed, all respondents were asked to list anyone with whom they had discussed important matters from their families, their high schools, or their dormitories. The final question on this page asked, "Is there anyone else you have discussed important matters with and not yet listed? Please list their names below regardless of whether or not they belong to any of the above groups." This procedure, even with the addition of the last non-group-specific prompt could bias the list of alters elicited towards those alters who are involved in organized or bounded groups to the exclusion of those who belong to none. However, I do not anticipate this to be a serious problem since the vast majority of alters interact with the respondent in some context and the largest and most important contexts for interaction are likely to be included in the list of contexts used in prompting for alters.[5]

I use the list of alters generated by the original name-generator to operationalize the alters who are named ("recalled") when respondents are presented with a name generator. Those alters elicited by the subsequent prompts ("prompted") are a subset of those alters

[4] The groups categories listed were: (1) dance, music, literary theater or other arts groups, (2) political parties or social action groups, (3) public service groups or clubs, (4) religious groups or clubs and (5) sports teams or clubs.

[5] Feld (1981) argues that social interactions are organized around what he calls foci. Although the concept of foci includes more than just the organized and bounded kinds of groups elicited here, these groups are examples of foci.

who were not recalled, i.e. initially forgotten. Comparisons of these two groups constitute the main evidence for testing my hypotheses.

After all the names had been elicited, respondents were presented with one page of name interpreters for each alter they had listed. These asked for demographic information about the alter, information about the respondent's relationship with the alter, information about the alter's relationship with other alters, and information about which of the respondents' groups the alter belonged to.

Twenty-four respondents, many but not all of them undergraduates, completed the survey. Of these, 14 were women and 10 were men. Ages ranged from 19 to 39 years old with a median of 22 years and a mean of 24.5 years. Thirteen respondents were white, three were black, four Asian, two Hispanic, and two identified their race as "other." While this is not a representative sample, I am aware of no evidence suggesting that the cognitive processes that serve as mechanisms here are likely to vary with demographic characteristics.

Respondents listed a total of 308 alters; 136 of these were recalled in response to the original name generator, and 172 of them were listed after prompting. Respondents listed an average of 12.8 alters, with a range from 3 to 31. On average 5.6 of these alters were recalled without prompting and 7.1 were listed after prompting, with the ranges running from 2 to 18 and 0 to 26, respectively. Fifty-two percent of alters listed were female. The ages of alters ranged from 19 to 56 with a mean of 29.3. Fifty-four percent of alters were white, 12.5% black, 16.7% Asian, 8.3% Hispanic and another 8.3% of a different race. Nineteen percent of alters listed were family members of the respondent.

6. Measures and analyses

The purpose of the analyses in this paper is to determine which properties of alters, if any, influence the likelihood of alters being "recalled" rather than "prompted." Therefore, the dependent variable is a dichotomous variable coded 1 if the alter was one of the alters elicited by the original name generator and 0 if the tie was elicited only after prompting.

Because the dependent variable is a dichotomy, I use logit models to prevent predicted probabilities from falling outside the required 0–1 range. However, a standard logit model is not appropriate because the unit of analysis is the alter and alters are not independent of one another—multiple alters are embedded in each of the 24 networks. Observations on alters within the same respondent's network are likely to be correlated and therefore the assumptions of a standard logit model are not met. Instead of the standard logit model I use random effects logit (Snijders and Bosker, 1999). This model estimates separate constants for each network. That is, though the effects of the independent variables on recalling are assumed to be the same for all respondents, each respondent has his or her own base probability of recalling an alter. The constant reported is the mean of the network-specific constants.

The random effects logit model:

$$\log\left[\frac{P_i}{1-P_i}\right] = \sum b_k X_{ik} + r_i \qquad (1)$$

predicts the logged odds of an event—in this case being remembered—for each unit (i) based on the estimated co-efficients (b) associated with the values of any number (k) of independent variables (X). P represents the probability of the event and r_i is the difference between the network-specific constant for each cluster and the overall constant. Based on the estimated variance of the random effects (r_i), one can calculate rho, the correlation between observations within the same cluster. This measures the extent to which observations within the same cluster are dependent; significant values of rho here indicate that alters within egocentric networks are not independent of one another.

Because the value being predicted is the logged odds—a measure rarely encountered outside of academic journals—the co-efficients estimated are not intuitively interpretable. In order to find the expected probability the predicted value must be exponentiated and divided by one plus itself. To save the reader this trouble, where effects are found I provide the expected probabilities of being remembered for selected values of the independent variables.

6.1. Measures of independent variables

Measures of the independent variables were calculated using data reported by the respondent in response to the name interpreters that comprised the final segment of the survey. I use three measures of tie strength. The first is the degree of closeness between the respondent and the alter as reported by the respondent. The survey asked respondents how close they felt to each alter they had listed. A pull-down menu offered three choices: not at all close (coded 1), somewhat close (coded 2), and very close (coded 3). Respondents who did not pull down the menu and make a selection were excluded from analysis. Data on closeness were available for 304 of the 308 alters.

The second measure of tie strength is multiplexity. Respondents were provided with a list of types of relationships that they might share with their alters: parent, sibling, other family member, neighbor, friend, roommate, boyfriend/girlfriend, advisor, and other. They were asked to check off all the relationship types shared with the relevant alter. Respondents who checked the box indicating "other" were asked to specify the nature of their relationship with the alter. The measure used is a count of the number of relationships selected and listed.

The final measure of the strength is the duration of the relationship between the alter and the respondent. To reduce respondent burden, respondents were not asked to enter the number of years they had known each alter. Instead another pull-down menu allowed respondents to choose a range of time for which they had known each alter. The available categories where "less than 6 months," "6 months to 1 year," "1–3 years," "4–8 years," "9–15 years," and "more than 15 years." I coded duration quantitatively by assigning the midpoint for each of the categories. The final category was coded as the midpoint between 15 and the age of either the respondent or the alter, whichever was younger.

The degree centrality of each alter was calculated based on respondents' reports of which alters within their networks knew one another. For each alter listed by the respondent, the respondent was presented with a list of all of the other alters that he or she had listed. The survey asked respondents to place a check next to the name of each of the other network members whom the alter in question knew well enough to greet. To determine if alters who are more connected to other alters are more likely to be remembered, I created a variable that counted the number of fellow network members that each alter knows. A second variable to be used in testing this hypothesis is the proportion of all fellow alters (both recalled and prompted) that each alter knows.

Group embededness was measured using data on group memberships that respondents provided in response to name interpreters, not from data on which group by which each alter's name was elicited. For each alter, respondents were presented with a list of the groups they had named as well as the three additional groups: family, dormitory and high school. The survey instructed them to check boxes next to the groups to which the alter belonged. I use both the number of groups to which each alter belongs and the proportion of the respondent's groups to which each alter belongs as measures of group embeddedness.

A third measure of group embeddedness is the number of other alters with whom a given alter shared group memberships. I calculated this by looking at the groups that each alter participated in and adding the total number of other alters in all of those groups. In determining which of the other alters were members of the relevant groups I used data from the name interpreter described in the previous paragraph, not data on which (if any) prompts elicited the alter's name.

7. Findings

7.1. Hypothesis 1: remembering and tie strength

I hypothesize above that respondents are more likely to remember their stronger ties. This is especially likely if some respondents interpret the original name generator as asking for a list of people who are important in their lives (Bailey and Marsden, 1999) rather than literally asking for a list of people with whom they discuss important matters. To test this hypothesis, I use three measures of tie strength: closeness, duration of the relationship, and multiplexity.

7.1.1. Closeness

Results show that respondents are more likely to remember alters to whom they feel closer (see Table 1, Model 1). The model predicts that for each additional unit of closeness alters increased their logged odds of being remembered by 1.7. To put it more intuitively,

Table 1
Random effects logit models predicting alters' probability of being remembered based on tie strength

	Model 1 (closeness)	Model 2 (multiplexity)	Model 3 Duration	Combined
Constant	−4.329 (0.696)	−0.013 (0.418)	−0.338 (0.244)	−4.461*** (0.808)
Closeness	1.710*** (0.264)	–	–	1.822*** (0.298)
Multiplexity	–	−0.056 (0.272)	–	0.004 (0.300)
Duration of relationship	–	–	0.035** (0.018)	−0.022 (0.021)
Rho	0.180***	0.170***	0.155***	0.191***
N	304	308	304	303

** Significant at the 0.05 level.
*** Significant at the 0.01 level.

the odds that alters who were somewhat close to the respondent were recalled were 5.5 times larger than the odds for alters who were not at all close to the respondent. Those who were very close to the respondent were very likely to be recalled (0.69 probability) while those who were not at all close were almost sure to be prompted (0.067 probability of being remembered).

7.1.2. Multiplexity

Alters who share more than one type of relationship with the respondent are likely to be stronger ties. Therefore, I expected that the more types of relationships alters shared with the respondent, the more likely they were to be remembered. Results here do not support the hypothesis that respondents are more likely to recall alters with whom they share more multiplex ties (see Table 1, Model 2).

7.1.3. Duration of the relationship

Results using this variable to predict the probability of an alter being recalled support the hypothesis that alters who have known the respondent longer are more likely to be recalled.[6] (See Table 1, Model 3.) However, the effects of this variable are relatively small: alters who have known the respondent for 15 years are only 12% points more likely to be recalled (.548 probability) than those who have known the respondent 1 year (.426 probability).

Although two of the indicators of strength used here are shown to influence the probability of being remembered, the analyses are problematic since each independent variable is examined separately and all three are indicators of the latent variable strength of tie. Therefore, introducing them separately could result in biased co-efficients. To test for this possibility, I entered the three variables together into a single model (see Table 1, Model 4).

When the three variables are considered together, neither multiplexity nor the duration of the relationship affect an alter's probability of being remembered. This suggests that duration of the relationship is important only because alters who have known the respondent longer are likely to be closer to the respondent. Among alters of equal closeness to the respondent, a longer relationship does not make an alter more likely to be remembered. The size of the effect of closeness on the probability of being remembered is slightly larger than the size of this effect in the bivariate model.

Although the effects for duration of the relationship falls away once closeness is controlled for, these effects are still substantively interesting and important because they continue to affect composite measures at the aggregate level. If analysts calculate the mean duration of a respondent's relationships this measure will be just as overestimated as it would have been if controlling for closeness had not caused the effects at the alter level to disappear.

[6] In analyses not shown I find that being kin does not affect an alter's probability of being recalled. Controlling for kinship does not change the co-efficient of relationship duration, suggesting that the effect of duration is not explained by kin's greater likelihood of having longstanding relationships with respondents.

Table 2
Random effect logit models predicting alters' probability of being alters' known remembered based on the number of fellow alters known

	Model 5 (number of alters known)	Model 6 (proportion of alters known)
Constant	−0.681 (0.309)	−1.463 (0.323)
Number of other alters known	0.143*** (0.045)	–
Proportion of alters known	–	3.368*** (0.660)
Rho	0.226***	0.116**
N	308	308

** Significant at the 0.05 level.
*** Significant at the 0.01 level.

7.2. *Hypothesis 2: connections to other alters and remembering*

Results of the analysis where the number of other alters each alter knows is used to predict the probability of being recalled support the second hypothesis. Alters who know more of their fellow alters are more likely to be remembered than those who know fewer. Each alter known increases the logged odds of being remembered by .143 (see Table 2). Thus alters who know none of their fellow network members have a 0.34 probability of being remembered compared to 0.44 for those who know three other alters, and 0.68 for those who know 10.

Using the proportion of other alters that each alter knows instead of the absolute number shows that respondents are also more likely to recall alters who know a greater proportion of their other alters. According to this model alters who know a quarter of the other alters cited by a given respondent have a 0.350 probability of being remembered, compared to 0.555 and 0.743 for alters who know half and three-quarters of their fellow alters, respectively. Alters who know all of their fellow network members have a 0.870 probability of being remembered.

7.3. *Hypothesis 3: group embeddedness and remembering*

I hypothesize above that group memberships may affect the probability of being remembered because they affect the probability that either a group or an affiliated alter will be triggered in memory, resulting in the naming of the relevant alter. Results indicate no statistically significant effect of the number of group memberships on likelihood of being recalled, however (see Table 3, Model 7).

It is still possible that group embeddedness matters, but that it is the proportion of the respondent's groups that each alter belongs to and not the absolute number of groups that matters. This is likely if we think of alters as first calling to mind groups and then naming alters from those groups—a given number of groups will be a different proportion of groups depending on the number of groups that each respondent belongs to. Again, though, there are no statistically significant results (see Table 3, Model 8).

Although neither of these variables show statistically significant effects on an alter's probability of being recalled, the co-efficients are in the expected direction and it is unclear

Table 3
Random effects logit models predicting the probability of being remembered based on group embeddedness

	Model 7 (number of groups)	Model 8 (proportion of groups)	Model 9 (number of co-members)
Constant	−0.280 (0.271)	−0.255 (0.283)	−0.099 (0.240)
Number of groups	0.141 (0.116)	–	–
Proportion of groups	–	1.030 (1.046)	–
Number of co-members	–	–	0.006 (0.024)
Rho	0.161***	0.168***	0.171***
N	308	308	308

*** Significant at the 0.01 level.

if the variables have no effect or if the sample size here is too small to produce statistically significant results.

The possibility remains that it is not the number or proportion of groups that matters, but the number of other alters to whom one is connected through those groups. This would be the case if after naming a particular alter, respondents name alters who share group affiliations with this alter.

This is not the same as naming others who the alter knows, since alters can belong to the same groups and not know one another if those groups are large or sparsely connected. Using the number of co-memberships to predict the probability of an alter being remembered did not show any significant relationship, though (see Table 3, Model 9). However, unlike the previous two measures of group embeddedness this variable produced a small confidence interval around 0. Therefore, in this case I am confident in concluding that even a larger sample size would be unlikely to reveal an effect on the probability of being remembered.

8. Network level implications

The analyses discussed above show that tie strength and embeddedness in the network influence the probability of a tie being elicited by the name generator used here. Since network level measures such as average tie strength, network density, and multiplexity are nothing more than composite measures calculated from alter level data, these measures will necessarily be different when they are based on data from only those alters elicited by the original name generator than if they are calculated based on all alters. However, it could still be the case that measures from recalled alters are reliable estimates of measures based on the more complete list of alters. That is, it is sure that if respondents are more likely to remember alters to whom they feel close, recalled mean closeness will be greater than total or prompted mean closeness. If the extent to which it is greater were constant across respondents this would create a high correlation between the two versions of the measure. Analysts interested relating these measures statistically to other variables (as opposed to simply describing individual networks) could use the measure based on recalled alters only and be sure that there results would be the same as they would be with the more complete measure. If the two kinds of measures are not well correlated, analyses more validly performed with the more complete list of alters could not be reliably estimated with the recalled network.

Table 4
Estimated regression parameters for network-level measures calculated with recalled names only predicting measures calculated with all names listed

Network level variable	Constant	Co-efficient for measure calculated with recalled names only	*R*
Mean closeness	0.755	0.638***	0.679***
Density	0.131	0.512***	0.740***
Mean years known	1.264	0.783***	0.879***
Network size	5.888	1.226***	0.547***
Log of network size	1.464	0.577**	0.492***

** Significant at the 0.05 level.
*** Significant at the 0.01 level.

To find out what the consequences are for measures of network properties, I begin by comparing the mean closeness, density, mean years the respondent has known alters, and network size calculated using only the recalled names to the same measures calculated using all names. Results of regressing the complete measures on those calculated from only recalled names are shown in Table 4. Though all the correlations are significant due to the part–whole relationship between the variables, the correlations are low enough to call the reliability of these measures into question. Correlations range from 0.879 for the mean number of years respondents have known their alters to 0.547 for network size.

These correlations indicate that network measures calculated from only those names elicited by the name generator are not reliable measures of network properties measured on a more complete subset of alters. It is still possible that these measures, particularly the measure of network size, are more reliable for some respondents than others. If respondents are more likely to remember some types of alters, it seems plausible that respondents whose networks have a greater proportion of these types of alters will remember a greater proportion of their alters. To determine if this is the case I predicted the probability of each alter being remembered based on network level measures of mean closeness, density, mean years respondents have known alters in their networks, and network size all calculated using the network composed of both recalled and prompted alters. Results indicated that respondents who have higher mean closeness, higher network densities, and smaller networks will remember a greater proportion of their alters (see Table 5). Based on these models, respondents with mean closeness of 1 would be expected to recall 5.9% of their alters compared to 71.6% for respondents with mean closeness of 3. Respondents with network densities of 0.25 are expected to remember just over one third of the alters while those with network densities of 0.75 are expected to remember two-thirds. Respondents with three network members would be expected to remember two-thirds of their alters compared to just under half for respondents with 15 alters.

Measurement error in measures of network properties can have serious consequences for models where those measures are used as independent variables. Co-efficients estimating the effects of the network properties on dependent variables will be biased. Where other independent variables are present in the model, co-efficients for those variables will be biased because the effects of the network measure will not be adequately controlled for. The direction of the bias in this case will depend on the direction of correlation between

Table 5
Random effects logit models predicting the probability of an alter being remembered based on composition of the network the alter is embedded in

	Model 19 (mean closeness)	Model 20 (density)	Model 21 (mean years known)	Model 22 (network size)
Constant	−4.620* (1.887)	−1.242** (0.421)	−0.727 (0.457)	0.868* (0.417)
Mean closeness	1.849** (0.770)	–	–	–
Density	–	2.777*** (0.946)	–	–
Mean years known	–	–	0.093 (0.060)	–
Network size	–	–	–	−0.066*** (0.025)
Rho	0.122***	0.090***	0.161***	0.123***
N	308	308	308	308

* Significant at the 0.1 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

the two independent variables and the direction of the network measure's effect on the dependent variable.

9. Summary and limitations

I have argued that the list of alters produced by the administration of a name-generator is a subset of the population of alters that the name generator asks for, and I outlined the reasons why that subset might not be a representative one. I then presented evidence that the list of recalled alters is biased towards those alters who are closer to the respondent, who have known the respondent longer, and who know more of the respondent's other alters. There was no significant tendency for respondents to recall those alters who are more embedded in the respondent's social settings or groups.

At the network level I find that composite measures calculated based only on recalled alters are not well correlated with the same measures calculated using all alters. This may suggest that using network level measures based only on alters elicited by a single name generator results in measurement error. Results from using network level measures to predict the probability of alters being recalled might further suggest that the size of this measurement error in estimates of network size would not be random, but related to properties of the network.

The implication of these findings, that data collected using a single name generator may be flawed, depends on the critical assumption that the list of alters collected using the combination of the name generator and prompts are a better representation of a respondent's network than the list collected with a single name generator. Here I address a number of issues that call this assumption into question.

9.1. A slipping threshold of importance

Respondents presented with the GSS name generator must define the vague concept 'important matters' before they can provide a list of names (Bailey and Marsden, 1999;

Bearman and Pirigi, 2003). It is not clear that their interpretation of this term is the same when it is applied to the name generator and the prompts. Some respondents may have one threshold for what matters are important that they apply to the name generator and then, when presented with the prompts, lower the threshold to include matters important to the group or activity in question or matters that, though equally important in the respondent's eyes, might not have been the same important matters the respondent considered when responding to the name generator. Respondents might do this either because the presentation of group names causes them to broaden the scope of topics they consider to be important or because the presentation of multiple prompts pressures them to provide additional names.

In either case, alters elicited by the name generator and those elicited by the prompts would not be comparable. The network based on all alters listed might not be a more complete network, but instead a different, larger, less selective network. These data do not allow me to determine if respondents have lowered their threshold of importance, though the number of potentially intimate alters who are not recalled (see below) suggests that at least some of the alters elicited through prompting would have been elicited without a reduced threshold. Future research in this area should examine this question by including name interpreters that ask respondents what subjects they discuss with each alter (similar to methods used by Bailey and Marsden, 1999 and Bearman and Pirigi, 2003) or by using name generators with criterion relationships that allow for less variety in respondents' interpretations of the question.

9.2. Prompted alters are less important than recalled alters

Related to the possibility of a declining threshold for 'important matters' is the possibility that alters whose names emerge only after prompting fail to emerge earlier because they are less important in the respondent's network. Examination of my data shows that even if what we are interested in is a network of intimates and not literally a discussion network, the combined network of those alters remembered and those not remembered is a more complete representation. Respondents failed to recall one-third of those alters they felt "very close" to and three quarters of those they felt "somewhat close" to. Twenty-four of 53 family members in the networks were elicited only with prompting. More specifically, of the 26 parents listed, 10 were not elicited by the original name generator even though 8 of those parents were alters the respondent felt very close to and the remaining 2 were alters respondents felt somewhat close to. Six of sixteen siblings were elicited after prompting, four of these being siblings who the respondent felt very close to. Similarly, four of the twelve boyfriend/girlfriend ties mentioned were not included in the original network, though three of the respondents who originally failed to list these alters reported feeling "very close" to them. In short, large numbers of people who would seem to belong to the network of intimates are being omitted.

9.3. Prompted alters are not representative of omitted alters

Alters elicited by the prompts used here may not be representative of omitted alters. Because the prompts ask respondents to name alters who are members of various groups they participate in, alters who have been omitted and participate in group activities with respondents will be more likely to be elicited by the prompting than alters who were omitted but do not participate in group activities. As I mention above, I do not believe that this is a serious problem in this data set because in general most non-kin ties originate from organized settings or activities. This is especially likely to be true of the sample used here in which most respondents were students.

Insofar as alters elicited by prompting may be unrepresentative of other omitted alters in this way, the result should be more conservative tests of my hypotheses, particularly the third hypothesis that alters who are more embedded in the respondents' social groups are more likely to be remembered. If omitted alters who belong to groups are more likely to be recalled through prompting than other omitted alters, then it should be the case that other omitted alters belong to fewer groups, and thus the test of the importance of group embeddedness used here is rendered more conservative. Furthermore, if belonging to more of a respondent's groups provides more opportunities to meet a respondent's other alters and increases degree centrality, then the test of the hypothesis that higher degree centrality increases the likelihood of being remembered is also more conservative. Therefore, although it may be the case that the alters elicited by my prompts are not representative of the omitted alters I do not believe that this possibility necessarily calls into question the validity of these findings.

10. Conclusion

Future research should begin by determining the extent to which these effects are consistent in larger samples or different populations. If these findings are duplicated in larger more representative settings, additional research should be directed towards adjudicating between alternative explanations, exploring the implications more fully and—if the effects found here are found to be consistent and problematic—evaluating possible adjustments in survey methods designed to minimize them.

First, these hypotheses should be examined by research using larger samples. Though the mechanisms that I propose here are cognitive structures that are unlikely to vary appreciably across populations, a more representative, less self-selected, less college-based sample would be required to demonstrate persuasively that these effects are widespread.

In addition to using improved samples, researchers should increase the scope of this research to look at other name generators in other settings. How would the findings reported here compare to findings where the name generator involved asked respondents to list people they go to for job-hunting help or advice on parenting? What sorts of criterion relationships are most prone to the problems described here? I could conjecture that since respondents with closer, smaller, denser and more long-lived networks forget to list fewer alters those criterion relations that are likely to form these kinds of networks would be less prone to the problems described here than larger, sparser, networks composed of weak or fleeting ties. However, this conjecture would require empirical verification, especially since it is not necessarily the case that the same factors would lead to forgetting for all criterion relations.

Finally, if the effects found here are confirmed by further research, and the mechanisms are found to relate to forgetting rather than shifting inclusion criteria, then attention should turn to how current methods can be modified to minimize these effects. The prompts used to elicit additional names here are time-consuming and tedious for the respondent. Furthermore, as the prompts elicit larger networks than the single name generator, using this method requires respondents to spend more time answering name-interpreters than they would if prompts were not used. Thus incorporating the kind of prompts used here into the network segments of large surveys where single name generators are normally used is not a feasible solution. Future research should focus on finding more practical means of reducing biases in data collection or of taking the biases into account when analyzing egocentric network data.

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