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Forgetting of friends and its effects on measuring friendship networks

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Abstract

We assessed the forgetting of friends and its effects on measuring personal and social network characteristics and properties. All 217 residents of a university residence hall first recalled as many of their friends in the hall as they could. Then, on a complete list of hall residents, residents indicated other friends they forgot to recall. On average, residents forgot 20% of their friends. Residents' demographic characteristics are unrelated to the proportion of friends forgotten. However, the number of friends recalled correlates moderately positively with the number of friends forgotten. Recalled and forgotten friends do not differ appreciably in terms of their individual characteristics, although residents on average had modestly closer relationships with recalled friends than forgotten friends. Forgetting also influenced the measurement of some social network structural properties, such as density, number of cliques, centralization, and individuals' centralities. More research is required to determine whether forgetting distorts measurement of structural properties in other settings.

1. Introduction

Arguably the most common method of collecting data on personal and social networks is to ask people to recall network ties of one type or another (Marsden, 1990). Perhaps one of the greatest concerns about recall data is the possibility that individuals forget relevant persons in response to network elicitation questions (Poole and Kochen, 1978). In addition to making recalled network data incomplete, forgotten ties could also distort measurement of various characteristics and structural properties of personal and social networks. In an accompanying review, Brewer (2000) surveyed the literature and found relatively few studies of forgetting that involved strong research designs. The

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literature review also indicated that no prior research has examined the effects of forgetting on the measurement of structural properties of personal and social networks.

In this paper, we address these gaps empirically in a detailed study of forgetting and its consequences. Specifically, we (1) estimate the level of forgetting for a particular relation (friendship); (2) attempt to predict which individuals are most likely to forget friends; (3) compare recalled and forgotten friends in terms of individual, relationship, and structural characteristics; and (4) describe the impact of forgetting on the measurement of various structural properties of personal and social networks.

2. Method

2.1. Subjects and setting

The data for this study were collected in one of the six residence halls located on the Australian National University (ANU) campus in Canberra during the second semester of 1987 (Freeman et al., 1998). All 217 residents who lived in the hall at the start of the academic year (including 104 females and 113 males) participated. There was one new resident in second semester who was not included in the study.

For 91 of the residents, 1987 was their first year living in this particular hall. Most residents had lived in the hall for one or more years prior (24 had been residents for at least 4 years). The majority of residents were undergraduate students studying at the ANU. A few residents were graduate students at the ANU and a number attended one of the other universities in the area. There also were a few who simply worked and did not attend any university. Residents' ages ranged from 18 to 35, with a mean of 20.3 years (s.d. = 2.3), and all but 15 of the residents were white.

Residents had opportunities to interact with each other in multiple social settings. On the ground floor of the building there was a dining hall where the residents were provided with three meals a day. The building also contained a bar and snack shop (both of which were open twice daily), a general common room with a large screen TV, a snooker room, and a library. All of the residents lived in single rooms that were located in one of two wings. Both wings had four floors and were connected only on the ground floor. All floors included both women and men, as well as a mixture of first year and longer-term residents. Each floor had a conversation area, toilet and shower facilities, and a small kitchen.

There were many organized activities within the residence hall that gave all residents further opportunities to interact with one another, including weekly Sunday ''morning teas,'' biweekly dances, monthly semi-formal dinners, occasional formal dinners, and occasional concerts performed by residents. Residents also could participate in the residence hall government and a number of sporting activities in which residents competed against residents from the other university residence halls.

2.2. Procedure

All residents were interviewed individually over a three-week period at the beginning of the university's second semester. During the interviews, subjects were asked to

perform a recall task and a recognition task concerning their friendship relations with other residents. Each interview began with asking the subject to think about all of the residents who were currently living in the residence hall. Subjects were then asked to perform the recall task. They were provided with a blank sheet of paper and asked to write the names of those residents whom they considered to be personal friends. A friend was defined as ''those individuals who you feel close to, who you interact with frequently, those who you would seek out to do some type of social activity.'' Subjects were not limited in the number of friends to name, but they were instructed not to include residents who were only acquaintances. Two subjects stated that there was no one living in the residence hall whom they considered to be a friend. Two others nominated only one other individual as being a friend. These four subjects were asked to recall anyone they thought of as an acquaintance, that is, someone with whom they typically ate their meals or could have a friendly conversation. Once a subject had completed recalling as many friends as she/he wanted, a line was drawn at the end of the list.

After completing the recall task, subjects were then provided with a list of names of all the residents (in alphabetical order) who were currently living in the residence hall. They were asked to go through this list and write down anyone whom they also considered to be a friend, but had forgotten to include earlier. Throughout the rest of the paper, we refer to the friends reported in this recognition task as ''recognized friends'' or ''forgotten friends.'' Once their list of friends was complete, subjects rated the strength of their relationship for each friend on a five-point scale (5 = best friend, 4 = close friend, 3 = friend, 2 = friendly acquaintance, and 1 = acquaintance).

3. Results

We analyzed these data with UCINET IV 1.66/X (Borgatti et al., 1993), ANTHROPAC 4.7/X (Borgatti, 1994), SYSTAT 4.0 (Wilkinson, 1989), and custom programs that we wrote in QuickBASIC 4.00 (Microsoft, 1987).

Virtually all subjects followed the instructions to recall just those friends living in the residence hall. Only one subject recalled a friend who did not actually live in the hall, and six subjects recalled a hall administrator who lived in the hall but was not included in the study. We did not include these recalled friends in any of our analyses.

3.1. Descriptive measures of forgetting

Table 1 shows basic descriptive statistics on the number of friends recalled, number of friends recognized, and personal network size (number of friends recalled + number

Table 1
Number of friends recalled, number of friends recognized, and personal network size

	Number recalled	Number recognized	Network size
Mean	9.48	2.90	12.38
Median	9	2	11
s.d.	4.52	3.38	6.73
Range	0 to 36	0 to 19	2 to 51

Table 2
Mean number of friends recalled and recognized for different relationship strengths

Relationship strength	Mean no. recalled	Mean no. recognized
5 (best friend)	1.33	0.07
4 (close friend)	2.51	0.29
3 (friend)	5.25	2.25
2 (friendly acquaintance)	0.24	0.26
1 (acquaintance)	0.15	0.03

of friends recognized) for the 217 subjects. Except for two subjects, all friends recognized by a subject had relationship strengths that were at least as strong as the weakest relationship strength of any friend recalled by that subject.

Table 2 presents the mean number of friends recalled and recognized for different relationship strengths. The majority of friends recalled and recognized have relationship strengths of 3 (''friend''). The relationship strengths for 96% of recalled friends and 90% of recognized friends were 3 or greater (i.e., subjects considered them to be best friends, close friends, or friends). One subject recalled no friends and 46 subjects recognized no friends.

Table 3 shows descriptive statistics on the proportion of friends recalled (i.e., number recalled/(number recalled + number recognized)) overall and for different relationship strengths. On average, subjects recalled 80% of their friends overall. In other words, subjects forgot 20% of their friends. The proportion of friends recalled is high for best friends and close friends, although recall is still incomplete for these strong ties. The proportion of relationship strength 3 friends (''friend'') recalled is moderate. Twenty-six percent of the 204 subjects who had a close or best friend forgot one or more close or best friends.

3.2. Predictors of forgetting

We attempted to identify meaningful correlates of two key measures of forgetting — the proportion of friends recalled and whether a close or best friend was forgotten. Three subject demographic variables (age, years of residence in dormitory, and sex) are essentially unrelated to both of these measures (Pearson correlations are less than or equal to $|0.11|$ with n's between 188 and 216). The number of friends recalled also is not

Table 3
Proportion of friends recalled, overall and for different relationship strengths

	Relationship strength					
	Overall	5	4	3	2	1
n	217	147	199	214	6	5
Mean	0.80	0.97	0.91	0.74	0.43	0.74
Median	0.83	1.0	1.0	0.76	0.44	1.0
s.d.	0.17	0.10	0.18	0.23	0.17	0.43
Range	0.00/1.0	0.50/1.0	0.00/1.0	0.00/1.0	0.23/0.66	0.00/1.0

associated with either of these forgetting measures ($r = 0.03$ [$n = 217$] for proportion of friends recalled and $r = 0.12$ [$n = 204$] for whether a close or best friend was forgotten). However, the number of friends recalled is moderately positively correlated with the absolute level of forgetting, i.e., the number of friends recognized, $r = 0.44$ [$n = 217$].

3.3. Comparisons between recalled and recognized friends' individual, relationship, and structural characteristics

To compare recalled and forgotten friends, we calculated, for each subject who forgot one or more friends, the Pearson (point biserial) correlation between whether a friend was recalled (yes = 2, no = 1) and each of a number of friend individual, relationship, and structural characteristics. Then, for each characteristic, we computed the unweighted mean of subjects' correlations by using Fisher's *z*-transformations (see Rosenthal, 1991) as well as other statistics on the distribution of subjects' correlations (see Table 4). In those cases where a friend characteristic variable is measured on an ordinal scale, we also calculated a version of Freeman's theta, the bivariate proportional reduction of error measure of association between a nominal scale variable and an ordinal scale variable (Freeman, 1965, 1976). Our version of theta allowed the statistic to take a positive or negative sign to allow comparisons across subjects (the categories for each variable and their ordering remained constant across subjects). The number of subjects included in the summaries in Table 4 differs across variables because some subjects' friends displayed no variation on particular characteristics, and therefore no correlations were calculable for these subjects.

The first set of friend characteristics refers to similarities between subjects and their friends in terms of their sex, room location in the residence hall, and length of residence in the residence hall (see first six rows in Table 4). Subjects were essentially equally likely to recall same-sex and opposite-sex friends. Subjects were slightly less likely to recall friends who lived on floors other than their own, and the likelihood of recalling a friend is very weakly negatively related to the ordinal floor distance (number of floors

Table 4
Summary of correlations for comparisons between recalled and recognized friends' personal network characteristics and properties

Personal network characteristic/property	*n*	Mean *r*	Median *r*	s.d.	Range
Same sex as subject (1) vs. opposite sex (0)	167	0.03	0.04	0.28	−1.0/0.67
Same floor as subject (1) vs. other floor (0)	164	0.11	0.17	0.31	−1.0/1.0
Ordinal distance between subject/friend floors	168	−0.08	−0.03	0.32	−0.91/0.47
Same wing as subject (1) vs. different wing (0)	158	0.04	0.01	0.33	−0.65/1.0
Years residence (abs. value diff. between subject/friend)	162	−0.07	−0.07	0.34	−1.0/0.74
Years residence (number of years)	163	−0.11	−0.09	0.32	−1.0/0.58
Relationship strength	164	0.30	0.29	0.20	−0.41/0.89
Reciprocity	160	0.22	0.25	0.34	−0.46/1.0
Core-periphery QAP	167	0.17	0.13	0.19	−0.45/0.70
Subgroup QAP	86	0.11	0.09	0.15	−0.35/0.61

one would have to ascend and/or descend) between subject and friend rooms. The theta results for ordinal floor distance are similar to the Pearson correlation results in Table 4 (mean and median = −0.08, s.d. = 0.43, range = −1.0 to 1.0). On average, recalled and forgotten friends were virtually equally likely to live in the same wing of the residence hall as the subject. Subjects were very slightly more likely to recall friends who had lived in the residence hall for a similar length of time as themselves than friends who lived in the hall for different (either shorter or longer) lengths of time. Friends who lived in the residence hall for relatively shorter periods were slightly more likely to be recalled than friends who had been living in the hall for relatively longer periods.

The second set of friend characteristics refers to aspects of subject–friend relationships. Subjects displayed, on average, a modest tendency to have closer relationships (stronger relationship strengths) with recalled friends than recognized friends. The theta analyses showed similar results to the Pearson correlations reported in Table 4 (mean = 0.34, median = 0.36, s.d. = 0.26, range = −0.67 to 1.00). For each subject, we computed the mean relationship strength for recalled friends and recognized friends. On average, recalled friends have modestly greater mean relationship strengths than recognized friends (recalled friends: mean = 3.55, median = 3.56, s.d. = 0.33, range = 1.67 to 4.40, $n = 170$ subjects; recognized friends: mean = 3.09, median = 3.00, s.d. = 0.39, range = 1.0 to 4.0, $n = 171$ subjects). Subjects' recalled friendship choices were somewhat more likely to be reciprocated (by either a recalled or recognized choice) than their recognized friendship choices (see Table 4). Across subjects, the mean proportion of reciprocated ties was 0.71 for recalled friendship choices ($n = 170$) and 0.47 ($n = 171$) for recognized friendship choices.

We also tested two hypotheses about the pattern of ties for recalled and forgotten friends. Both hypotheses were stimulated by a few of Hammer's (1984, p. 343) speculations. The first hypothesis is that recalled friends form the ''core'' of a subject's personal network and that forgotten friends are structurally more peripheral in the subject's personal network. The second hypothesis is that recalled friends and recognized friends constitute distinct subgroups in which all recalled friends are directly tied to each other, all recognized friends are directly tied to each other, and recalled friends and recognized friends constitute non-overlapping cliques (Luce and Perry, 1949).

We used the Quadratic Assignment Procedure (QAP) (Hubert and Schultz, 1975) to examine these hypotheses. QAP involves computing the Pearson correlation between the off-diagonal values of a data matrix with the off-diagonal values of a structure, or hypothesis, matrix (each treated as a vector). We arranged a square, symmetric data matrix for each subject such that the first k rows and columns refer to the k friends recalled and the next l rows refer to the l friends recognized (i.e., forgotten). The cell values in a subject's data matrix could range from 0 to 2. A ''0'' value indicates no tie (neither recalled nor recognized) between a pair of friends. A ''1'' value refers to an unreciprocated tie (either recalled or recognized) and a ''2'' value refers to a reciprocated tie (recalled or recognized). Webster's study of reported and observed informal social interaction among employees of an accounting firm provides an empirical basis for this coding of ties (Webster, 1995). In that study, observed interaction for pairs of persons involved in a reciprocated tie was greater than observed interaction for pairs

involved in an unreciprocated tie, which in turn was greater than that for pairs not directly tied by reported informal social interaction. It should be noted that our data on ties in a subject's data matrix are based on *friends*' reports of their ties with each other, and *not* on the subject's perception of those ties. We used symmetrized data because the two hypotheses tested refer to interaction patterns, which by definition involve symmetric ties. In essence, we used the friendship data as a proxy for data on interaction.

For the ''core-periphery'' hypothesis, we created for each subject a structure matrix that contains cell values of ''1'' for pairs of recalled friends and cell values of ''0'' for all other pairs of friends (i.e., for pairs of recognized friends and pairs involving one recalled friend and one recognized friend). Such a structure matrix models the situation where all recalled friends are tied directly to each other, and no recognized friend is tied to any other friend.

For the ''subgroup'' hypothesis, we created for each subject a structure matrix that contains cell values of ''1'' for pairs of recalled friends and pairs of recognized friends, and cell values of ''0'' for pairs involving one recalled friend and one recognized friend. For this hypothesis, we required that each subject included in analysis have at least three recalled and three recognized friends to ensure that the hypothesized ''subgroups'' included more than a mere pair of friends. Fig. 1 presents a hypothetical illustration of a data matrix and a structure matrix for each of the hypotheses.

The last two rows of Table 4 show the results for the QAP analyses. On average across subjects, forgotten (i.e., recognized) friends are slightly more peripheral in a subject's personal network than recalled friends. That is, recognized friends tend to have slightly fewer ties with each other or with recalled friends than recalled friends have with each other. For the typical subject, recalled friends and forgotten friends show an even milder tendency to form different subgroups. Sixty-two of the 86 subjects with a QAP r for each hypothesis had a stronger (more positive) r for the ''core-periphery'' hypothesis than the ''subgroup'' hypothesis. This suggests that the ''core-periphery'' hypothesis provides a better, albeit still poor, description of the data than the ''subgroup'' hypothesis. In comparing the QAP results with the other results in Table 4, it is important to note that the unit of analysis for a QAP correlation is the friend *pair*, not the individual friend.

The final set of comparisons between recalled and forgotten friends focus on friends' centrality in the *social* network involving all hall residents (each of whom served as a subject and was tied to at least one other resident). We calculated each resident's centrality for each of four common measures (degree, closeness, betweenness, and information) (Freeman, 1979; Stephenson and Zelen, 1989). We constructed the input matrix for the centrality analyses by dichotomizing ties (1 = a tie of any relationship strength, 0 = no tie) and then symmetrizing them based on the union rule, such that ''1'' refers to a reciprocated or unreciprocated tie and ''0'' refers to no tie. The results in Table 5 indicate that, on average, there is a very slight tendency for recognized friends to be more central on each of the measures than recalled friends.

3.4. Impact of forgetting on measurement of structural properties of networks

To gauge the impact of forgetting on the measurement of structural properties of networks, we compared networks based on recall data only with those based on

Data matrix

	A	B	C	D	E	F	G	H
A	-	1	2	0	0	2	0	1
B	1	-	1	1	0	0	1	0
C	2	1	-	0	0	0	0	0
D	0	1	0	-	1	0	1	1
E	0	0	0	1	-	2	0	0
F	2	0	0	0	2	-	1	1
G	0	1	0	1	0	1	-	0
H	1	0	0	1	0	1	0	-

"Core-periphery" hypothesis structure matrix

	A	B	C	D	E	F	G	H
A	-	1	1	1	0	0	0	0
B	1	-	1	1	0	0	0	0
C	1	1	-	1	0	0	0	0
D	1	1	1	-	0	0	0	0
E	0	0	0	0	-	0	0	0
F	0	0	0	0	0	-	0	0
G	0	0	0	0	0	0	-	0
H	0	0	0	0	0	0	0	-

"Subgroup" hypothesis structure matrix

	A	B	C	D	E	F	G	H
A	-	1	1	1	0	0	0	0
B	1	-	1	1	0	0	0	0
C	1	1	-	1	0	0	0	0
D	1	1	1	-	0	0	0	0
E	0	0	0	0	-	1	1	1
F	0	0	0	0	1	-	1	1
G	0	0	0	0	1	1	-	1
H	0	0	0	0	1	1	1	-

NOTE: In this illustration, friends A, B, C, and D were recalled and friends E, F, G, and H were recognized.

Fig. 1. Hypothetical illustrations of QAP data and structure matrices.

combined recall and recognition data. At the personal network level, we computed, for each subject, the density of ties among recalled friends based on the recall data only and among all friends based on the combined recall and recognition data. We dichotomized

Table 5
Summary of correlations for comparisons between recalled and recognized friends' social network centralities

Social network centrality measure	*n*	Mean *r*	Median *r*	s.d.	Range
Degree	169	−0.04	−0.02	0.33	−0.92/0.72
Closeness	170	−0.07	−0.09	0.32	−0.83/0.72
Betweenness	170	−0.11	0.01	0.33	−0.93/1.0
Information	170	−0.04	−0.05	0.34	−0.82/0.81

ties as before, and then calculated densities for both the unsymmetrized and symmetrized (by the union rule) data. Personal network density tends to decrease very slightly when the recognition data are included (see Table 6; results exclude two subjects who each recalled only one friend). If the combined recall and recognition data are considered to be the complete and criterion data on friendship ties, then the recall data demonstrate reasonably good validity with respect to measurement of personal network density. The Pearson correlation between personal network density based on the recall only and the combined recall and recognition data is 0.92 for the symmetrized data and 0.93 for the unsymmetrized data. In addition, the number of recalled friends serves as a fairly good relative proxy for overall network size (i.e., number of friends recalled + number of friends recognized), $r = 0.89$ ($n = 217$).

To assess the impact of forgetting on measurement of social network properties, we created one 217×217 matrix based on recall data only and another based on the combined recall and recognition data. For all analyses, we dichotomized ties and for some analyses we also symmetrized ties in these matrices, as described earlier. We dichotomized ties because most structural measures require binary data. Furthermore, in many situations researchers are not able to interview all individuals in the network. In such cases, researchers use information about all reported ties, even if both individuals in a reported tie were not interviewed. Therefore, we used the union rule in symmetrizing ties to make our analyses relevant to these circumstances. For the recall only and combined recall and recognition matrices, we measured several network properties, including density, reciprocity, mutuality (Katz and Powell, 1955; Achuthan et al., 1982; computed with the DYADS program, Walker and Wasserman, 1987), transitivity, number of cliques, and four types of centralization. We also performed a triad census (computed with the TRIADS program, Walker and Wasserman, 1988; Wasserman and Faust, 1994) on the unsymmetrized data.

Some differences in social network structure appear (see Table 7). Density increases roughly in proportion to the amount of additional ties included with the recognition data.

Table 6
Descriptive statistics on personal network density for recall only and combined recall and recognition data

	Recall only	Recall + recognition
Symmetrized data		
n	215	215
Mean	0.45	0.43
Median	0.41	0.39
s.d.	0.23	0.21
Range	0/1.0	0/1.0
Unsymmetrized data		
n	215	215
Mean	0.36	0.35
Median	0.33	0.33
s.d.	0.20	0.19
Range	0/1.0	0/1.0

Table 7
Social network properties for recall data only and combined recall and recognition data

	Recall only	Recall + recognition
Density		
symmetrized	0.06	0.08
unsymmetrized	0.04	0.06
Proportion of ties reciprocated	0.60	0.63
Mutuality		
Katz–Powell	0.58	0.60
Achutan–Rao–Rao	0.60	0.63
Transitivity		
symmetrized	0.31	0.30
unsymmetrized	0.31	0.30
Number of cliques (symmetrized data)		
union rule	551	869
intersection rule	177	292
Centralization		
degree (%)		
symmetrized	15.3	18.2
indegree	6.8	10.1
outdegree	12.4	18.1
betweenness (%)		
symmetrized	7.6	5.9
unsymmetrized	7.8	6.6
closeness (%)	12.0	25.3
information (var.)	1.2	1.9

The level of reciprocated ties and mutuality of friendship choices also increase slightly once the recognition data are added to the recall data. The level of transitivity is essentially the same whether the recall data only or combined recall and recognition data are used. The transitivity values in Table 7 indicate the proportions of unordered triads that are transitive (excluding vacuously transitive triads) for the symmetrized data and the proportions of ordered triples that are transitive (excluding vacuously transitive triples) for the unsymmetrized data. The number of cliques of size 3 rises meaningfully for the symmetrized data based on the union rule as well as the intersection rule (where only reciprocated ties are included). Cliques of greater sizes show even larger relative differences (e.g., for cliques of size 5, there are 160 cliques in the recall only matrix and 320 cliques in the combined recall and recognition matrix for the symmetrized data based on the union rule). The centralization indices (Freeman, 1979; Wasserman and Faust, 1994) show changes, with degree centralization rising somewhat, betweenness centralization falling slightly, closeness centralization increasing substantially, and information centralization rising moderately after including the forgotten ties. Furthermore, there is moderate variation across centrality measures in the degree of the correspondence between residents' centralities based on the recall data only and the combined recall and recognition data (degree $r = 0.92$, betweenness $r = 0.89$, closeness $r = 0.79$, information $r = 0.87$).

Table 8
Triad censuses for recall only data and combined recall and recognition data

Triad type	Recall only		Recall + recognition	
	frequency	*z*	frequency	*z*
003	1,389,122	4.27	1,315,464	13.16
012	155,199	−4.20	180,419	−12.62
102	118,332	10.86	155,010	7.65
021D	1897	11.75	3316	26.53
021U	1741	7.59	2648	11.72
021C	2223	−13.25	2970	−20.33
111D	3800	−8.94	6054	−13.25
111U	3095	−19.93	6143	−12.16
030T	262	28.21	386	29.13
030C	15	−0.73	5	−4.85
201	1956	−24.40	3899	−29.07
120D	405	56.99	561	52.68
120U	202	25.22	397	34.62
120C	180	10.90	273	8.39
210	724	54.54	1311	62.28
300	427	71.96	724	73.54

The triad censuses for the unsymmetrized recall only and combined recall and recognition data (Table 8) succinctly show many of the main findings already described. The *z* scores in Table 8 indicate the deviations of the observed values from that expected by the U/MAN random digraph distribution (see Wasserman and Faust, 1994). The results reflect the ties added from including the recognition data as well as the general similarity between the two matrices with respect to reciprocity and transitivity.

To get a visual sense of the structural changes due to the additional ties in the recognition data, interested readers may visit any of the following Elsevier sites on the World Wide Web: http://www.elsevier.nl/locate/son, http://www.elsevier.com/locate/son, or http://www.elsevier.co.jp/locate/son. The images of the social network at these sites are based on correspondence analysis (Weller and Romney, 1990) of the 217×217 matrix of combined recall and recognition data and were produced with MAGE (Richardson and Richardson, 1992; Freeman et al., 1998). These images distinguish ties identified by the recall data from those identified by the recognition data.

4. Discussion

On average, subjects forgot 20% of their friends. Subjects even forgot 3% of best friends and 9% of close friends on average. Seventy-nine percent of the subjects forgot at least one friend, and 26% of the subjects who had a close or best friend forgot one or more close or best friends. In our study, demographic variables are essentially unrelated

to forgetting. The number of recalled friends is not related to the proportion of friends recalled, although it is moderately positively associated with the *number* of friends forgotten.

For those subjects who forgot any friends, recalled and forgotten friends did not differ appreciably, on average, in terms of their gender similarity to the subject, proximity to the subject's room in the residence hall, similarity to the subject in length of residence in the hall, or simple length of residence in the hall. On average, subjects had modestly closer relationships with recalled friends than forgotten friends. Recalled friends were also mildly more likely to reciprocate friendship choices than forgotten friends. Furthermore, forgotten friends were slightly more peripheral than recalled friends in subjects' personal networks. Recalled and forgotten friends did not differ meaningfully in terms of centrality (on several measures) in the residence hall's friendship social network. Other research also indicates that forgetting in the recall of personal and social network members is significant, that there are no good predictors of how much an individual forgets in proportional terms, and that subjects are modestly more likely to forget persons with whom they have relatively weak relationships (Brewer, 2000).

Forgetting had relatively little impact on measurement of mean levels and individual differences in personal network density and individual differences in personal network size. At the level of individual subjects, personal network density based on recall data only can serve as a reasonable proxy for density based on combined recall and recognition data. Although network size based on recall data produces substantial underestimates of personal network size due to forgetting, personal network size based on recall data only still is a fairly good substitute measure (in correlational terms) for network size based on the combined data.

Forgetting had little or no impact on the measurement of some social network properties, but had more moderate impact on others. The recall data and the combined recall and recognition data show very similar levels of transitivity, reciprocity, and mutuality. The triad censuses for the recall data only and the combined recall and recognition data are also fairly similar. This finding is consistent with Holland and Leinhardt's assertion that measurement error (forgetting in this case) does not significantly alter the triad census profile (Holland and Leinhardt, 1973). However, the recall data and the combined recall and recognition data display noteworthy differences in social network density, number of cliques, most measures of centralization, and some measures of individuals' centrality (most notably, closeness). More research in other settings is required to determine the generality of these results on social network structural properties, as our study is based on a single social network.

It is not clear whether our subjects had idiosyncratic and ambiguous notions of friendship as did respondents in the northern California (USA) survey of personal networks by Fischer (1982). Our subjects displayed a reasonably high degree of reciprocity (over 60%), which suggests our subjects defined ''friend'' similarly. Any idiosyncrasy in the concept of ''friend,'' furthermore, would not alter any interpretations of our results on the extent of forgetting, subject predictors of forgetting, most comparisons between recalled and forgotten friends, or the impact of forgetting on the measurement individual differences in personal network size.

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