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HOW MUCH OF A NETWORK DOES THE GSS AND RSW DREDGE UP?

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> *At my twenty-fifth high school reunion, last year, you would have been proud of me. The way I called those names up, with seldom even a quick half glance at a tag ... their names came to me like the list of vowels, because I had learned them when I was fresh, back before I had met or heard of 375,000 other Americans. By the time anyone gets to be 43, if he has followed current events and been out of town a few times, two-thirds of the names he hears sound vaguely, but only vaguely, familiar.*
> (From *Not Exactly What I Had in Mind*, Roy Blount, Jr. The Atlantic Monthly Press, 1985)

One of the fundamental questions in network analysis is: Who is in anyone's network and how can we find out? Generally, the question is answered by invoking a "network name generator." All name generators produce a subset of some larger, general network, but there are no validation criteria for deciding whether one name generator produces a better subset than any other such instrument. Partly to overcome this problem, Killworth and Bernard (1978) invented a technique called RSW, which exhausted a larger fraction of an informant's network by asking for a list of first intermediaries in over 1200 small-world experiments per informant. RSW produces important data about how people know one another, but for survey purposes it is very time consuming and difficult to administer.

The 1985 General Social Survey (GSS) had a network component, designed by Burt (1984, 1985) that used the following name generator: "Looking back over the last six months, who are

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the people with whom you discussed matters important to you?" This name generator has been used in several major surveys, and appears to tap cognition about a person's affective network. In the experiment reported here, six informants completed both the GSS and RSW surveys, and their networks were compared on many different criteria to see if they overlap, and by how much.

Introduction

1985 was an important year for network analysis. A representative sample of Americans was, for the first time, asked about their networks in the General Social Survey (GSS), conducted by the National Opinion Research Center. The GSS is expensive – $600,000 – so getting the network questions tacked on to this national survey was an important achievement, due largely to the efforts of Burt (1985). In implementing the GSS network component, Burt used a name generator as follows: "Looking back over the last six months, who are the people with whom you discussed matters important to you?" Informants were probed for up to five choices; if they offered more choices, only the first five were recorded.

Burt decided to use the GSS name generator for several reasons: (1) It had been used in some form before, in major networks studies by Wellman in Toronto (1979) and by Fischer in northern California (1982; see also McCallister and Fischer 1978). (2) It elicits "a tractable number of people" (Burt 1984: 18). (3) "Discussing personal matters" is stable across respondents in terms of its mixture with other qualities of relationship, such as friendship, kinship, and so on (ibid). (4) So long as one wants to elicit the names of intimates, the GSS name generator appears a valid probe for this purpose (ibid). Overall, the technique is easy for interviewers to use; it is easy for respondents to understand; and it doesn't take a long time to administer.

Two sets of questions come up quickly: (1) Is intimacy what we want to measure? What differences are there in networks based on intimacy (affect) and networks based on instrumental relations? (2) In general, if intimacy and instrumentality are the basis of different networks, then what is the overlap? How much of a person's total network does the GSS name generator dredge up?

The research we report on here was designed to compare characteristics of the networks dredged by the GSS name generator and by the Reverse Small World technique (RSW).

RSW is a standard list of 500 targets in a fictional small world problem. It was developed by Killworth and Bernard in 1978 order to: (1) get a an estimate of how many people are actually in anyone's average network and understand what differences in network size depends on; (2) investigate the nature of the penultimate links in a small-world study; (3) understand more about the decisions involved in the *process* of moving a folder across a set of small world links; (4) look for the rules governing who people know and why they know each other.

Each target in RSW is supplied with information about occupation, location, hobbies, and other information needed by informants to make a first choice (first intermediary) on a small world chain to the target. The information supplied is generated by the informants themselves in a prior technique, called INDEX (Bernard *et al.* 1982). Since these techniques are well-described elsewhere, we won't go into them further here. Suffice to say that RSW is an exhausting, and exhaustive instrument to work with, and it produces a large fraction of people's networks.

Of course, we have no idea whether the network produced by RSW is more useful or more interesting than networks produced by other instruments. But it occurred to us that, lacking any criterion variable on which to choose a network generator, we could a least compare networks dredged up by these two techniques: the GSS name generator, based on an *affective* probe (who do you discuss important matters with?), and the RSW technique, based on an *effective* probe (who would you start 500 small world chains with, given certain characteristics of 500 targets?)

We did six repetitions of our experiment. In each case, we asked an informant to answer the network component of the GSS. Then the informant did the RSW. At the end of the RSW, informants were shown 60 randomly selected pairs of choices they had made (over the 500 targets) and were asked: do the (60) pairs know each other? For each affirmative case, the informant was asked, for each triad (informant, pair choice A, pair choice B), who knows whom better. In other words, does A know B better than the informant knows A? and so on. We also asked informants to provide their first intermediary to each of six famous people (Ronald Reagan, Muhammed Ali, Jane Fonda, etc.), and we asked the last two informants whether they "discussed important matters with" any of the people who appeared in the 60 pairs.

(We only asked the last two informants this question because it didn't occur to us earlier.) Finally, each informant answered a short questionnaire about themselves. On average, this took about 8 hours per experiment, not including coding, which requires another 4 hours per experiment.

Clearly, our six informants are not a representative sample of contemporary America, as the GSS sample is. We selected three men and three women. Their average age is 40 (compared to 45 in the GSS sample). All our informants are white. Four informants are married, one is divorced, and one has never been married. Four of them are Protestants, one is Catholic, and one listed "other" for his religion. Three of our informants completed high school, one has finished a year of college, one graduated from college, and one is a retired lawyer. On socioeconomic and demographic characteristics, our six informants are very much like those in the GSS.

Despite the shortcomings that may be inherent in our sample, the results of our research are strong. We did six repetitions of an experiment, in which we tested the outcome of one method of generating networks against the outcome of another. Here's what we found.

Findings

We examined 15 variables (see Table 1, p. 61). Variable #1 is straightforward: How many people in an informant's network are dredged up by the RSW instrument? On average, our six informants used 160 different first intermediaries, or choices, for the 500 targets in RSW. This is well within the bounds of what we have found in dozens of other RSW experiments. In Killworth and Bernard (1978), the mean number of choices for 40 informants was 210, using an instrument with 1267 targets. In Killworth, Bernard and McCarty (1984), the mean for another 40 informants was 135 choices over 500 targets.

The first thing we asked was: How many of the 5 GSS choices appear in the top 5 and top 10 choices made by informants on RSW? (Recall that there are 500 *targets* in RSW and only 160 *choices*, on average, so some choices are more used than others.) Of the 30 GSS choices made collectively by our 6 informants, 4 of them are among the 30 top 5 choices made by those informants on the RSW. One more, or a total of 5 are among the 60 top 10 choices.

Is this a small amount of overlap or a large amount? What are the chances that these results would occur randomly? Suppose that all 5 of anyone's GSS choices were contained in his or her 160 (on average) RSW choices in this series of experiments. If there were no connection between a GSS choice and being a top 5 RSW choice, then the GSS choices would be scattered randomly throughout the list of RSW choices. The chance, then, of any GSS choice being in the top 5 RSW choices is $q = 5/160$ (0.031). The chance of *not* being in the top 5 RSW choices is $p = 1 - 5/160$ (0.969). In other words, 4 choices occurring is probably a significant degree of overlap. Furthermore, respondents rely on some of their RSW choices a good deal more than they rely on others and thus the actual p-values will be higher since respondents' choices are not truly independent.

We get 30 chances for a hit, since there are 6 informants, each of whom made 5 top RSW choices. Now,

the chance of getting 0 in the top 5 $= p^{30} = 0.386$,
the chance of getting 1 in the top 5 $= {}^{30}C_1 p^{29} q = 0.373$,
the chance of getting 2 in the top 5 $= {}^{30}C_2 p^{28} q^2 = 0.175$,
the chance of getting 3 in the top 5 $= {}^{30}C_3 p^{27} q^3 = 0.053$.

So, the chance of fewer than 4 turning up in 5 *random* top RSW choices equals $0.386 + 0.373 + 0.175 + 0.053 = 0.987$. In other words, there is only a 1.3 percent chance of getting 4 or more GSS choices in the top 5 RSW choices. (Because of the lack of true independence among RSW choices, this figure could become greater than 5 percent).

Next we asked our data whether the informant's *top* (that is, first) GSS choice was in his or her top (that is, most used) 10 RSW choices (variable #4 in Table 1). Two of our informants' top GSS choices made it into their top 10 RSW choices. The probability of any GSS choice *not* being in the top 10 RSW choices is $p = 1 - 10/360$. The probability of being in the top ten is $q = 10/360$. With six separate experiments, we get six independent chances of a hit. The probability, then, that *none* of the GSS choices would turn up in the top ten RSW choices is $p^6 = 0.679$ and the probability that 1 will turn up is ${}^6C_1 p^5 q = 0.272$, for a combined total of 0.951. In other words, there is a 4.9 percent probability that 2 or more GSS choices would turn up randomly in the top 10 RSW choices of our 6 informants, making this overlap probably significant.

Next we asked (variable #5): How many of the GSS choices ever appeared in the top 10 RSW choices of our informants? There were 30 GSS choices, and 60 RSW top 10 choices. On average, GSS choices are used 14 times in our informants' top 10 RSW choices, or in about 10 percent of the (on average) 147 targets handled (out of 500 targets) by informants' RSW top 10. (In two cases, several choices tied for last place in the RSW top 10. If a GSS choice was one of those, we used the GSS choice, in order to be as fair as possible.)

The chances are very slim that this could happen by chance. The probability of not being one of the top ten RSW choices is $p = 1 - 10/160$, and $q = 10/160$. We have 30 chances for a hit, so the probability of GSS choices *never* being used to handle any of the targets that are handled by our informants' top 10 RSW choices is $p^{30} = 0.144$. The probability of a GSS choice being used just once is $p = 0.289$; the probability that GSS choices might be used twice is $p = 0.279$. There is a 0.99 probability that GSS choices will be used 5 times. The chances, then, that they are used 14 times (averaging over the 6 informants) are much, much smaller than even a 0.001 level of confidence.

For the next variable (#6) we asked: How many GSS choices were *ever* used to handle *any* of the 500 RSW targets? Three informants used all 5 of their GSS choices at least once, somewhere in the RSW task, but three informants used only three of their GSS choices in RSW – that is, two of their GSS choices *never* made it into the list of RSW choices, even on 500 independent tries – and this despite the fact that some of our informants reported that they talked to their GSS choices every day.

Extending this (variable #7): How many *times* were GSS choices *ever* used to handle the RSW targets? There were six informants who made a total of 30 GSS choices. They made a total of 3000 RSW choices. Of those 3000, a total of 176 (6%) overlap with the 30 GSS choices. In other words, given 500 independent chances each to choose a first intermediary in a small world task, on average, informants choose someone from their 5 GSS network choices about 29 times (about 6%). On average (variable #8), about 30 percent, or 147 RSW targets are handled by each informant's top 10 choices. In Killworth and Bernard (1978), 30 percent of the 1267 targets were handled by an average of 16 choices. In Killworth et al. (1984), 8 choices handled 30 percent of the 500-target world that we gave informants to work with. Since informants made 160 choices, on average, about 6 percent of

their choices (10/160) handle 30 percent of the world for the instrumental task we give people in our experiments, and about 94 percent of their network are intermediaries between them and 70 percent of the world. This is consistent with our findings in previous iterations of the experiment, as shown above.

On average (variable #9), 2 out of 5 GSS network choices are a respondent's kin. Among the top 5 RSW choices (variable #10), the figure is 2.5, on average. Among the *next* five RSW choices (variable #11), the figure is 1.33, for a total average on variable 11 of 8.33 choices. As expected, fewer kin are named among less important in RSW. Among the top five choices, the result is nearly identical with the data from the GSS. This means that we can not explain the differences between the GSS network and the RSW network on the basis of kinship connectivity. Just because RSW asks informants to dredge up their network on the basis of an instrumental probe, this seems to have little effect (when compared to the results from the GSS) on how often they will think about their kin as important (top five in both cases) people in their network.

Among the 10 possible opportunities for the 5 GSS choices to know one another, our informants report that their GSS choices actually know each other, on average, 55 percent of the time. This is a nice, comforting datum, indicating a relatively dense network among top choices, just as expected from prior studies (such as those done in Toronto and northern California). It is comforting, too, because two of our informants volunteered information regarding the possibility that any name generator might produce capricious data. According to them, the fact that the GSS name generator asked them to think back over the last six months was an important consideration in who they chose to name in their networks. In one case, the informant was evolved in some litigation. The informant mentioned a lawyer as a person with whom important matters were discussed regularly during the past six months. In another case, the informant's son had been working with a therapist; the informant mentioned the therapist as a person with whom important matters were discussed during the past six months. In neither case, we were told, would those names have been generated if the question had not been phrased the way it had – that is, asking people to think back over the last six months about people with whom they had discussed important matters.

One of our informants reported that 100 percent of his GSS choices

knew one another (variable #12), He is 70 years old and he reports that the number of RSW choices he made is less than it would have been some years ago. Quite simply, he says, many of the people whom he would have used as instrumental choices in RSW have died. Indeed, the GSS data show that network density (reports by respondents that their GSS choices know one another) increases with age (Marsden 1985).

Investigating the density of the RSW network is another matter (variable #13). Since each informant made, on average, 160 choices, the matrix of potential questions that informants would have to answer (of the form: does *i* know *j*?) is staggering. We chose 60 random pairs of numbers from 1–500 as a sample of that matrix and presented it to informants when they had finished the RSW. From this sample, we find that, on average, an informant's RSW choices know each other 26 percent of the time (compared to 55 percent for the GSS choices). The GSS is twice as dense a network as the RSW network. This finding may be complicated by the fact that 60 randomly selected pairs of choices out of 160 does not result in 120 different choices each time.

Finally, we compared the GSS and RSW on the question: are the network choices especially close (variable #14 and #15). Our informants report that, of 10 possible pairs of GSS alters, on average, 1.5 are especially close (variable #14). This is a volatile statistic, however: Three informants reported none of the 10 pairs were especially close. One of them (the 70 year old man with the dense network), reported that 6 were especially close.

Compare these data to the results of the triad test that we did on the 60 pairs (plus informant) from the RSW (variable #15). On average, 26 percent of the possible hits (among pairs who the informant says know each other) are "especially close." At least, our informants report that the members of the pairs are closer to each other than the informant is to either or both members of the pair.

So, the GSS network appears more dense than the RSW network, but the RSW network appears more close. This is a very tentative finding, but it is tantalizing. Are the people you "discuss important matters with" (presumably strong ties) more likely to know one another than the people you mobilize instrumentally to get things done in your world? Are the instrumental people in your network (presumably weak ties) more likely, on average over all possible pairs, to be closer to one another than you are to them?

Granovetter (1982) suggests that strong ties connect close friends and relatives, and result in dense networks, such as those affective groups identified by our GSS data. Weak ties, by contrast, produce dispersed networks, but those ties are crucial bridges between "clumps of close friends" (1982 : 106). Could this explain why the RSW choices appear closer to one another than our informants are to the choices?

We also tested the hypothesis that that perhaps the GSS choices were used more for local targets on RSW. There are 11 targets on the RSW from Florida, Georgia, Alabama, North Carolina, and South Carolina, GSS choices were used only twice out of the possible 55 hits.

We asked the last two of our informants to go through the 60 random pair list of choices from their RSW and tell us if any of those choices were people with whom they "discussed important matters." One informant listed 2 names, in addition to the GSS-5, who fall in that category, for a total of 7. The other informant said that 20 people in the 60 pair list would be people to "discuss important matters with." Two of the 20 were already on the informants's GSS-5. One of the GSS-5 did not appear on the 60 pair list, and 2 of the GSS-5 never appeared in the RSW at all, so they could not have been chosen for the 60 pair list.

Although we tested this with only two of our informants, it seems likely that a great many more choices than 5 may need to be elicited in order to get a good picture of the affective network which the GSS name generator appears to tap. The problem, of course, is that time and money were limited in the GSS study, and eliciting more names would not have been feasible.

Discussion

The two network generators we have studied are tapping different cognitive sets of alters, but small but significant amounts of overlap. The GSS, we believe, is tapping the relatively smaller, strong-tie, affective network, while the RSW is tapping the vastly larger, weak-tie, effective network discussed by Granovetter (1982). As a crude test of this hypothesis, we asked our informants to name their first choice chains to each of six celebrities (Jane Fonda, Muhammed Ali, Ronald Reagan, etc.). The GSS choices were never used by two of the informants; four informants each used one GSS choice apiece. All four of

those GSS choices were also top 10 RSW choices. We think that this supports our conception of the RSW as an instrumental, weak-tie generator, compared to the GSS which is a strong-tie, affective name generator.

This conclusion is also supported by an earlier finding made by Granovetter, but never reported. In the pilot study for his research on finding a job, Granovetter asked 10 people to name the 5 people with whom theny spent the most time socially, and whether those people knew each other or not. Then he asked the respondents about who had helped them find a job. There was virtually no overlap between the two lists, and this is what led Granovetter to conclude that the weak ties of acquaintanceship could be instrumentally strong. However, since he was interested in the instrumental case of how people used others in their network to help find a job, he dropped the affective name generator from his research (Granovetter, personal communication).

We have learned a lot from the GSS network data. Comparing the GSS choices with those generated by RSW has made matters slightly more complicated, but more interesting, by raising a useful question: What are the theoretical and applications uses of the different networks that we are dredging up? Consider this: According to Jacobson (1985), Shulman pointed out in 1972 that about half the people classed as 'intimates" were replaced in a network study within a year. Minor (1983) discussed a longitudinal study of former heroin addicts; of 4200 people mentioned as network contacts in the three-wave panel study, only 19 percent occurred in all three waves.

Jacobson (1985) mentioned these findings in his survey paper on the concept of boundary maintenance in support networks. He concluded that this was evidence of great general turnover in network membership. Without our current data, this conclusion is quite reasonable. However, from our findings, it appears more realistic to say that people's networks are much, much larger than we have assumed, and that they dredge up a piece of their network in response to a particular name generator in a social science experiment. In real life, they dredge up a piece of their network for instrumental and affective purposes *as those pieces are needed*. Those pieces might overlap, or they might not. It is not up to our informants to give us their "networks." It is up to *us* to know which part of informants' networks we are dredging with our particular instruments, and what those parts of networks are used for. The small set of strong ties might be instrumentally useful for some

things (like borrowing money), but not for others; and the large set of weak ties may be affectively useful for some things (pouring one's heart out to strangers), but not for others.

As a further example of the difference between these kinds of ties, recall Mitchell's (1969) distinction between action-set and network, and Hammer's (1983) conceptualization of "core networks" and "extended networks." Hammer suggested that lower class networks were more heavily populated by kin and that their networks may consequently be less capable of delivering social and other resources on demand from any ego. Similarly, Granovetter (1982 : 108) suggests that upper and lower class people have strong clique ties only to persons in their own socioeconomic class, with relatively few weak ties to persons in other classes. By contrast, members of the middle class, he says, have greater "cognitive flexibility" because they have more ties to, and hence knowledge of, persons in other classes.

These are useful suggestions that can be tested, but we caution again that the conclusions drawn may be the result of the name generators used to study people's networks. We hope that the results of our work will stimulate experimentation on the use of different name generators, and on how people think about, and use, their networks.

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Description of variables in Table 1

1. Number of different choices informant made on RSW instrument.
2. Number of GSS choices found in informant's top 5 RSW choices.
3. Number of GSS choices found in informant's top 10 RSW choices.
4. Rank of informant's top GSS choice in informant's top 10 RSW choices.
5. Number of targets handled by Informant's combined GSS choices in the targets handled by informant's top 10 RSW choices (percentage figured by dividing number of hits listed in this variable by the number of targets handled by informant's top 10 RSW choices as listed in variable #8).
6. Number of GSS choices ever used in RSW.
7. Number of times any GSS choice is ever used in RSW (percentage figured by dividing this number by 500).
8. Number of 500 possible targets that are handled by informant's top 10 RSW choices (percentage figured by dividing this number by 500).
9. Number of kin in informant's GSS choices.
10. Number of kin in informant's top 5 RSW choices.
11. Number of kin in informant's top 10 RSW choices.
12. Number of GSS choices who know each other (and percentage out of a possible 10).
13. Number of pairs of RSW choices who know each other (and percentage out of a possible 60).
14. Number of GSS alters who are especially close to one another (and percentage out of a possible 10).
15. Number of RSW alters who know each other better than informant knows either. (Percentage figured by dividing this number by twice the number listed in variable 13, since each pair represents two chances.)

Table 1
Comparison of GSS and RSW methodologies

Variables	Informant number						Mean	Standard deviation
	1	2	3	4	5	6		
1. Number of unique RSW choices	131	151	134	186	202	153	159.50	25.05
2. Number GSS in top 5 RSW	1	0	1	1	1	0	0.67	0.49
3. Number GSS in top 10 RSW	1	0	1	2	1	0	0.83	0.75
4. Rank of top GSS in top 10 RSW	1	0	4	0	0	0	0.83	1.60
5. Number GSS hits in top 10 RSW	34	0	20	19	13	0	14.33	8.97
(Percentage)	(18.6)	(0.0)	(11.4)	(17.8)	(12.9)	(0.0)	(10.11)	(7.21)
6. Number GSS choices used in RSW	3	3	5	5	5	3	4.00	0.98
7. Number times GSS used in RSW	46	22	47	35	13	13	29.33	13.31
(Percentage)	(9.2)	(4.4)	(9.4)	(7.0)	(2.6)	(2.6)	(5.87)	(2.66)
8. Number handled by top 10 RSW	183	138	175	107	101	180	147.33	33.11
(Percentage)	(36.6)	(27.6)	(35.0)	(21.4)	(20.2)	(36.0)	(29.47)	(6.62)
9. Number of kin in GSS choices	2	3	2	2	0	3	2.00	1.10
10. Number of kin in top 5 RSW	4	4	4	3	0	0	2.50	1.84
11. Number of kin in top 10 RSW	5	7	4	3	2	2	3.83	1.86
12. Number GSS know each other	5	5	5	10	4	4	5.50	2.25
(Percentage)	(50.0)	(50.0)	(50.0)	(100.0)	(40.0)	(40.0)	(55.00)	(22.45)
13. Number RSW know each other	14	21	13	11	25	8	15.33	6.38
(Percentage)	(23.3)	(35.0)	(21.7)	(18.3)	(41.7)	(13.3)	(25.56)	(10.63)
14. Number GSS close alters	0	2	0	6	0	1	1.50	2.23
(Percentage)	(0.0)	(20.0)	(0.0)	(60.0)	(0.0)	(10.0)	(15.00)	(22.30)
15. Number RSW close alters	4	11	14	3	10	5	7.83	4.04
(Percentage)	(14.3)	(26.2)	(53.8)	(13.6)	(20.0)	(31.3)	(26.53)	(13.80)