NO MAN IS AN ISLAND: SOCIAL DISTANCE, NETWORK FLOW, AND OTHER-REGARDING BEHAVIORS IN A NATURAL FIELD EXPERIMENT

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—Abstract —
A natural field experiment is designed to explore the impacts of social distance and network flow on other-regarding behaviors. A greater degree of communication between the voluntary organization and volunteers was found to reduce their social distance and thereby improve volunteering commitment. The improvement was even more notable if the party initiating communication was the voluntary organization. Two other practical means of lessening social distance were for volunteers to learn more about other volunteers, and for information to be dispersed throughout the organization more rapidly. Additionally, this study shows a reversed "U-shaped" relationship between network flow and volunteering commitment.

Key words: *Volunteering, Social distance, Network flow, Natural field experiment, Other-regarding behaviors*
JEL Classification: C93 D03 D64[1]

[1] We would like to thank Jie Zhang, Haoming Liu, Songfa Zhong and Tiago Freire for their valuable suggestions at several stages of this research; Bingyu Zhang, Yan Zhang and Yunfeng Lu made useful comments on an earlier draft; Qiushi Fu and Xudong Chen contributed to data collection.

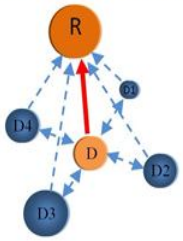
1. INTRODUCTION

Social distance (SD) describes that people will act favorably to those with higher social similarities, and the economic literature on its relationship with other-regarding behaviors (ORBs) is not sufficient. Furthermore, anonymity among participants is taken as a standard assumption in economic studies on SD, partly explained by the concerns about potential loss of control over social intersections (Roth, 1995). However, the social interactions in reality are usually neither completely anonymous nor completely familiar, due to some clues on others' characteristics acquired by people in interactions. Hence, it is an inevitable trend to break the anonymous condition.

In addition, ultimatum game and dictator game are two classic games used in the previous studies of SD and ORBs. The ultimatum game is a two-player game, in which the decision maker gets an amount of money ("the cake"), and decides how to divide the "cake" between himself/herself and his/her partner. The allocation will be implemented if the partner accepts the proposed split; otherwise, both get zero. The dictator game, as a simple form of ultimatum game, does not allow the partner to refuse the proposed split.

A "symmetric" interaction, referring to no rivals on both sides, is assumed in these two games, implying that the "split cake" has to be given by the designated dictator (no other whence) and to the designated recipient (no other whither). We argue that the real interactions are more complicated than what the ultimatum and dictator games could capture. For instance, the blood donation, one of typical ORBs, involves *a few* "hospitals" (recipients) and *a lot of* donors, which could be simplified as one "strong" recipient with more than one "weak" donor. The amount and frequency of blood donation will be affected not only by the SD between donor and recipient, but also the distance among donors. Another typical example of ORBs is volunteering in popular sports, where our experiment is set, with only one "strong" recipient (voluntary organization) and more than one "weak" time-donor (volunteer). Likely, the quality and length of volunteering will be influenced by SD between voluntary organization and volunteer, as well as the distance among volunteers.

Figure 1: Social Distance andNetwork Flow



Apart from the SD, Möbius and Szeidl (2007) proposed to measure the value of relationship by the "density" of two partners, called network flow (NF). Figure 1 shows the difference between SD and NF. RD is the shortest distance between Recipient (R) and Donor (D), defined as SD; while the NF is increasing due to more bridges between R and D (R-D1-D, R-D2-D, R-D3-D and R-D4-D).

Collaborated with CHINAOPEN 2011, one of the top tennis tournaments, a natural field experiment was designed to explore the relationship among SD, NF and ORBs, based on a more realistic social setting rather than the traditional "symmetric" dictator or ultimatum game. The paper is structured as follows: In Section2, the literature review of SD and NF on ORBs are given, followed by three hypotheses. The details of the experimental procedure are spelled out in Section3. Section4 presents the experimental results. Finally, conclusive remarks will be given in Section5.

2. LITERATURE REVIEW AND HYPOTHESES

The social identity theory, proposed first by Tajfel and Turner (1979) has motivated more attention to the influence of SD on ORBs. Chen and Li (2009) provided a thorough literature review of SD and ORBs, and found that most studies adopt the lab experiments with control of anonymity. As mentioned earlier that anonymity as the standard assumption has been broken by some researchers, for example, Andreoni and Petrie (2004), found the reduction of SD after showing the photos of other participants; Charness and Gneezy (2008) disclosed the participants' names, resulting in an increase of altruism.

Some less stylized experiments (e.g. List and Price, 2009; Fong and Luttmer, 2010) find social tie useless in the donation, deviating from the traditional view that a lower SD leading to a higher pro-social behavior. We think the mixed evidences may be explained by two reasons: Firstly, the previous studies assume that the SD will be lower if two parties have higher similarities in limited released dimensions. A yes conclusion for this assumption is that all the participants have same preference in those unreleased information dimensions. However, the

unobservable factors cannot be ignored or taken as the same, because various people will place distinct weight in the uncertainties. Our study does not limit the initial similarities with respect to a few dimensions; instead more communication is put forward to reduce SD. Besides, dispersing the same information more rapidly may be another approach to lower SD.

Hypothesis 1: *Volunteering commitment will be improved with the reduction of SD caused by more communication and acquiring the information in advance.*

Another explanation for ambiguous results may come from the games (ultimatum or dictator) chosen by previous researchers. To capture the "asymmetric" properties of ORBs in real settings, this paper proposes the following hypothesis2:

Hypothesis 2: *A higher level of volunteering commitment will be observed: if the "strong" side (voluntary organization) initiates the communication; or with a shorter distance among the "weak" side (volunteers) by more information about other volunteers.*

This paper argues that the NF could capture some information excluded in the SD, because one might lose more by "cheating" or decreasing the donation if both sides share more friends in common, but the marginal benefit from additional "friend" is decreasing. Based on this, the hypothesis3 is given as follows:

Hypothesis 3: *The rise of NF benefits the quality of volunteering, yet their positive relationship is not monotonic but "reversed U-shaped".*

3. EXPERIMENTAL DESIGN

To test the hypotheses, the volunteers in CHINAOPEN 2011 provide us an exciting opportunity to adopt a natural field experiment, in which the intervention is novel, not subject to any potential shortcomings of laboratory experiment. 1555 volunteers was recruited mainly from six universities in Beijing for CHINAOPEN 2011, and among them 130 are team leaders who manage and evaluate the other volunteers, that is, one leader is in charge of 10 volunteers on average. The CHINAOPEN 2011 lasts for 16 days, from September 25th to October 10th 2011.

On the basis of time, the experiment is divided into three stages:

Stage1: Pre-event survey. The pre-event survey is conducted to collect the basic information of volunteers on September 17th and 18th 2011 when all volunteers are trained together, and 1173 out of 1200 copies of questionnaires are collected back before September 20th 2011.

Stage2: Mid-term survey. All the volunteers will be evaluated on a standard scale of 1-7 (*Evaluation Form for Leaders*) [2] by their own leader during September 25th - October 10th. The time of evaluations differ slightly according to the concrete positions, but comply with the *"Middle-Principle"*: *If a volunteer needs to work from October 1st to October 10th, the evaluation will be conducted in the middle of this period, around October 4th – 5th*.

Based on five treatments, the volunteers are randomly assigned to six groups (Table1): Control, Initiative, Interactive, Temporal, Peer and Temporal-Peer group; all leaders are in one group, called Leader group.

Table 1: The Treatment of Groups

Treatment \ Group	Control	Initiative	Interactive	Temporal	Peer	Temporal-peer
Initiative communication	×	√	√	√	√	√
Interactive communication	×	×	√	√	√	√
Temporal distance	×	×	×	√	×	√
Peer information	×	×	×	×	√	√

The treatments are designed in terms of communication. *Initiative communication (IC1)* treatment means that the volunteers will receive *Evaluation Form for Leaders* including their performance from their leaders, that is, the "strong" side voluntary organization represented by leaders initiates a communication in the middle of the voluntary period. *Interactive communication (IC2)* treatment adds self-assessment (*Self-Assessment Form*[3]) by the volunteers themselves one or two days before receiving *Evaluation Form for Leaders* like that in *IC1*. If the *Self-Assessment Form* includes the sentence "*you will receive the feedback from your leader in the future 1-2 days*", it is defined as *Temporal distance (TD)* treatment; in other words, the information about feedback from leader is timely. The last treatment *Peer-information (PI)* refers to the median score of all

[2] The *Evaluation Form for Leaders* will be provided as requested.

[3] The *Self-Assessment Form* will be provided as requested.

volunteers under one leader; With PI, the volunteer knows his/her own as well as his/her peers' performance in group, resulting in a shorter distance among the volunteers.

Stage3: Post-event survey. At the end of CHINAOPEN 2011 (After October 10th, 2011), all the volunteers will be evaluated by their leaders once more by the same *Evaluation Form for Leaders*. However, this evaluation form will not be returned to volunteers no matter which group they are in.

The fixed hours volunteered in CHINAOPEN cannot be used to measure the volunteering commitment. To cope with this difficulty, this study takes advantage of leaders, who accompany their volunteers during the entire CHINAOPEN. As a result, their evaluation could reflect the volunteers' performance to some extent. The subjectivity caused by different leaders will be alleviated by using a "relative score", measured by the "difference" of two average evaluation scores (Post-event and Midterm) from the same leader. Additionally, the leader fixed effect is also used to reduce this bias from the perspective of econometrics.

4. EMPIRICAL ESTIMATION AND RESULTS

After striking out the invalid observations, the remaining valid observations (939 in total) are encoded, and then analyzed by STATA. The results from Pre-event survey[4] show that most of volunteers are undergraduates (around 96.27 percent), and the volunteers below 26 years of age make up more than 99 percent. Although the volunteers are very young, almost half of them have volunteering experience before, proving the popularity of youth volunteering in China recently. In our sample, *network flow (NF)* is defined as the number of volunteers from the same university ("friends") a volunteer has in his/her own group, since the sense of university honor will be strengthened with more "friends" around. We find that 80 percent of volunteers have "friends".

$$P(Y_2 - Y_1|X) = \emptyset\ (\alpha + \beta \text{Initiative}) \quad (1)$$

$$P(Y_2 - Y_1|X) = \emptyset\ (\alpha + \beta \text{Initiative} + \gamma_1 NF + \gamma_2 \text{Initiative} * NF) \quad (1')$$

$$P(Y_2 - Y_1|X) = \emptyset\ (\alpha + \beta \text{Interactive}) \quad (2)$$

$$P(Y_2 - Y_1|X) = \emptyset\ (\alpha + \beta \text{Interactive} + \gamma_1 NF + \gamma_2 \text{Interactive} * NF) \quad (2')$$

[4] Statistical description of volunteers in CHINAOPEN 2011 will be provided as requested.

The Logit regressions are used to test the effect of IC1 and IC2 as below. Equation (1) and (1') examine the communication initiated by the "strong" voluntary organization, while equations (2) and (2') involves an interactive communication between volunteers and voluntary organization. The dependent variable is defined as Progress if Y_2-Y_1>0; otherwise Non-progress. The explanatory variable for (1) and (1') is an Initiative dummy variable, 0 for control group and 1 for Initiative group; while for (2) and (2') is an Interactive dummy variable, 0 for Initiative group and 1 for Interactive group； NF, as control variable, is 0 if the volunteer is the only one from his/her university; otherwise 1.

Table 2: Logit Estimates of the Initiative Communication on Volunteering

	Basic	Basic with Fixed Effect	Network Flow	Network Flow with Fixed Effect
Initiative Communication	0.516**	0.582*	1.302***	1.977***
	(2.26)	(1.87)	(3.13)	(3.14)
Network Flow			-0.004	0.317
			(-0.01)	(0.93)
Initiative and Network			-1.008**	-1.743***
			(-2.34)	(-2.71)
Number of observations	312	205	312	205
Log likelihood	-213.586	-76.094	-210.348	-75.661
Pseudo R^2	0.012	0.057	0.027	0.006

Note: (a) Entries in Table represent the coefficients from separate regressions of the relevant independent variables; (b) t-statistics are in parenthesis; (c) *, **, and *** denote significance at the 10%, 5%, and 1% levels.

The econometric estimates for the IC1 and IC2 treatments are reported in Table2 and Table3 respectively. The coefficients of the IC1 (Table2), 0.516 and 0.582 (with leader fixed effect), show over 50 percent possibility for volunteers to put more effort in if the voluntary organization take the initiative to communicate. Furthermore, with control of NF, this positive relationship has been maintained and strengthened to 1.302 and 1.977, consistent with our hypothesis 1. The negative sign of the intersection of IC1 and NF implies that the marginal benefit from communication begins to fall after a limit of "friends".

Table 3: Logit Estimates of the Interactive Communication on Volunteering

	Basic	Basic with Fixed Effect	Network Flow	Network Flow with Fixed Effect
Interactive Communication	-0.052	-0.030	0.176	0.350
	(-0.23)	(-0.10)	(0.39)	(0.58)
Network Flow			-0.063	0.097
			(-0.26)	(0.30)
Interactive and Network			-0.271	-0.446
			(-0.59)	(-0.72)
Number of observations	312	204	312	204
Log likelihood	-214.978	-77.868	-214.716	-77.596
Pseudo R^2	0.001	0.001	0.002	0.001

Note: (a) Entries in Table represent the coefficients from separate regressions of the relevant independent variables; (b) t-statistics are in parenthesis; (c) *, **, and *** denote significance at the 10%, 5%, and 1% levels.

Compared to the IC1, the regressions for interactive communication (IC2), shown in Table3, cannot find any significant results, indicating the "asymmetric" power (hypothesis2) of the volunteers and the voluntary organization. In other words, the increment of communication from "weak" volunteer, conditioned on IC1 (receive the feedback from leader), contributes less to his/her performance.

$$P(Y_2 - Y_1|X) = \emptyset\,(\alpha + \beta_1 \text{Temporal} + \beta_2 \text{Peer} + \beta_3 \text{Temporal} * \text{Peer}) \quad (3)$$

$$P(Y_2 - Y_1|X) = \emptyset\,(\alpha + \beta_1 \text{Temporal} + \beta_2 \text{Peer} + \beta_3 \text{Temporal} * \text{Peer} + \gamma_1 \text{NF} + \gamma_2 \text{Temporal} * \text{NF} + \gamma_3 \text{Peer} * \text{NF} + \gamma_4 \text{Temporal} * \text{Peer} * \text{NF}) \quad (3')$$

Equations (3) and (3') examine whether the SD will be altered by delivering more information regarding other volunteers. The dependent variable is same as before, but the explanatory variables include three dummy variables: Temporal Distance equals 1 for Temporal group and Temporal-peer group, 0 otherwise; Peer Information is 1 for peer group and Temporal-peer group, 0 otherwise; and their intersection. The estimates are shown in Table4.

Table 4: Logit Estimates of the Temporal Distance and Peer Information on Volunteering

	Basic	Basic with Fixed Effect	Network Flow	Network Flow with Fixed Effect
Temporal Distance	0.026	0.286	1.216***	1.610***
	(0.11)	(1.12)	(2.80)	(3.39)
Peer Information	0.078	0.185	0.251	0.472
	(0.34)	(0.71)	(0.65)	(1.08)
Temporal-Peer	0.008	-0.179	-0.800	-0.952
	(0.03)	(-0.50)	(-1.22)	(-1.37)
Network Flow			0.131	0.282
			(1.70)	(1.30)
Temporal & Network			-1.521***	-1.706***
			(-3.40)	(-3.50)
Peer & Network			-0.219	-0.370
			(-0.55)	(-0.82)
Temporal-Peer & Network			1.015	1.025
			(1.42)	(1.34)
Number of observations	627	527	627	572
Log likelihood	-431.081	-244.393	-422.850	-234.909
Pseudo R^2	0.001	0.651	0.019	0.004

Note: (a) Entries in Table represent the coefficients from separate regressions of the relevant independent variables; (b) t-statistics are in parenthesis; (c) *, **, and *** denote significance at the 10%, 5%, and 1% levels.

$$Y_1 = \alpha + \beta NF + \gamma X \quad (4)$$

$$Y_1 = \alpha + \beta NFM + \gamma X \quad (4')$$

$$Y_1 = \alpha + \beta_1 NFD_1 + \beta_2 NFD_2 + \beta_3 NFD_3 + \beta_4 NFD_4 + \gamma X \quad (4'')$$

$$Y_1 = \alpha + \beta NFR + \gamma X \quad (4''')$$

Table 5: OLS of Network Flow

	NF	NFM	NFD	NFR
NF	0.424***			
	(7.49)			
NFM		0.158***		
		(6.03)		
NFD1			0.329***	
			(5.20)	
NFD2			0.603***	
			(8.83)	
NFD3			0.363***	
			(3.43)	
NFD4			0.186	
			(1.13)	
NFR				1.234***
				(6.27)
Number of observations	939	939	939	939
F-value	56.05	36.38	20.31	39.33
Pseudo R^2	0.043	0.017	0.055	0.015

Note: (a) Entries in Table represent the coefficients from separate regressions of the relevant independent variables; (b) t-statistics are in parenthesis; (c) *, **, and *** denote significance at the 10%, 5%, and 1% levels.

While all coefficients without control for NF are not significant, TD treatment sees a great improvement, reaching 1.216 and 1.610, after adding NF. This shows the value of timely communication, echoing hypothesis1. The coefficients of PI treatment are not significant, but the positive signs show a potential trend to pro-social behaviors by conveying more information about other volunteers.

To test the impact of NF, another important measure of relationship, OLS regressions are purposed as following (4) to (4'''). The initial evaluation score Y_1 is chosen as the dependent variable, since no treatments about SD are implemented at the first stage. The explanatory variables in four regressions are slightly different: NF is same as previous，a dummy variable, 0 for the volunteers who have no other "friends" within the leader, otherwise 1; NFM further depicts the specific number of the volunteer's "friends", excluding himself/herself; NFD_n is a dummy variable, denoting the "n-friend" category a volunteer belongs to (n = 0, 1, 2, 3, 4 in our sample). To solve the bias from the group size within one leader, NFR is defined as NFM/group size. All the results are presented in Table 5.

All the coefficients of network flow, measured by NF, NFM NFD or NFR, are positive, showing its beneficial impact on the volunteering quality. Specifically, having "friends" (NF) encourages the volunteers to increase their evaluation score by about 0.4 under the 7-scale score system; while a relatively lower improvement (0.158) by NFM implies that the positive influence from the network flow is not monotonic. This conjecture, also stated in hypothesis 3, has been supported by the coefficients of NFD_n, i.e. NFD2>NFD3>NFD1>NFD4 (0.603 > 0.363> 0.329 > 0.186), that is a reversed "U-shaped" link between network flow and ORBs.

5. CONCLUSION

One of the advantages by a natural field experiment is to identify the causal effect by randomized control at no expense of imposing an artificial environment. Based on a natural field experiment, our paper contributes to the measure of SD without any limitation of initial similarities between the two parties. Instead, more communication is proposed to reduce SD in our experiment, and moreover, our results show that the "strong" side who initiates the communication would give a larger fall of SD. In addition, a timely communication is also an efficient approach

to lower the SD. Last but not least, the NF (density) could capture additional information of the social network. In particular, the influence of a denser NF on ORBs is positive at the first stage, but this good impact will not last beyond a dense limit. In other words, a "reversed U-shape" gives a more precise description of the relationship between NF and ORBs.

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