Collegial Networks and the Integration of Russian Immigrant Scientists in Israël

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Introduction

The phenomenon of scientists migrating from one country to another is worldwide, and studying the patterns and transformation of their collegial networks is of theoretical and practical interest. Collegial networks are patterned informal communication ties among colleagues of a professional group through which pertinent information is exchanged. Network linkages provide opportunities for, and constraints on, access to important and scarce resources necessary for scientific research, such as information, skills, and power. A basic tenet of the network perspective is that the structure or patterns of network ties shapes actors'attitudes and behavior ; for instance, it has been found that scientists who participate directly or indirectly in collegial networks are usually more productive than isolates.

Immigrant scientists usually encounter a situation in which their ties to peers in the country they left are severed or weakened and new associations in the country of destination have not yet been formed. The development of new ties is therefore extremely important. Indeed, the lack of personal and professional connections that would link them to the local scientific and professional communities, and establish access to resources necessary for their work, was one of the most difficult problems reported by scientists and engineers who immigrated to Israel from the Soviet Union in the mid-1970s (Toren 1984). At that time the Soviet Union was a relatively closed political, social, and scientific system in which individual scientists had very limited contacts with colleagues in Western centers of science. In the present study I describe and analyze the patterns of intellectual and professional ties of immigrant scientists who have recently immigrated to Israel from the former Soviet Union, in the second large wave of this migration, mainly in 1990/91.

Types of Collegial Networks

Two types of networks are distinguished and compared : the intellectual-influence network and the professional-support network.

a. The intellectual network, circle, or environment of a particular scientist is comprised of other scientists who influence his or her research intellectually. The resources exchanged through the ties connecting network members are mainly cognitive C ideas, scientific information, paradigms, models etc. The structural properties of the intellectual network such as, size, composition, density and range, influence and shape the scientist's research performance and guide his\her production of new knowledge.

b. The second type of network is the professional-support network. Respondents were asked

to name persons who contributed to their professional integration in Israel by helping, teaching, or training in professional matters and by providing connections to other scientists and institutions.

One-hundred and twenty-three scientists working in universities were interviewed. They mentioned a total of 430 individuals when asked to name persons whose ideas and research influenced their own scientific work (the intellectual influence network) ; of these only 8 persons were named more than once. A total of 448 persons were named by respondents when asked to name those who gave them professional help (the professional support network) ; here thirty-six persons were mentioned more than once.

The data show that the overlap among scientists'individual networks is negligible. This is partly due to the fact that we are not dealing with a bounded population (such as a prepared list of names) for which all ties linking persons to one another, directly or indirectly, are examined. Rather, the data here are egocentric, concerning the collegial networks surrounding each individual scientist and the connections among the members of these networks, according to her or his own report. There are almost no ties among the networks of the individual scientists in the included in the study.

I first compare the intellectual influence and professional support networks in terms of their structure. Structural properties of networks can be classified into two broad categories. One concerns the properties of *ties*, such as strength or intensity, multiplicity (the variety of resources that flow through them), homophily (the resemblance between ego and named alters), etc. The other category includes the characteristics of the *network itself*, such as size, range, composition, density, and the like.

Findings

Size and Range

The intellectual-influence and professional-support networks do not differ significantly regarding average size : the Means are B 3.49 and 3.64 respectively. Nevertheless, the intellectual influence network is of wider range (from 0 B 10 persons listed) and dispersion SD = 2.29 ; the respective values for the support network are from 1 B 9, and the standard deviation is smaller SD = 1.87. Put another way, the names of colleagues cited as influencers are widely scattered ; not even one can be regarded as a sociometric 'star' or leader of a research group, school, network, or clique of scientists.

Density

The density of a network is measured by the ratio of empirical ties to possible ties among the scientists named by a respondent as composing his/her professional-support network or intellectual-influence network. When everyone knows everyone else the density is 100 % (ratio = 1.0) ; when no one or only one name is mentioned, or ties are absent among network members, the density is 0. The findings show that the support network is more densely-knit than the influence network (the mean densities are. 76 for the support network, and. 53 for the intellectual influence network). In the professional support networks ties are absent (0 density) in 11 % of the cases, and 58 % were completely connected. By comparison, in the influence network zero density appeared in 26 %, and maximum density in 35 % of the networks.

Intensity

Regarding the professional-support network intensity or strength of ties is measured by frequency of personal meetings between ego and a colleague in the network. Overall, the results

show a high rate of personal contacts in the support network. The intensity of contact, like density, is mainly due to the fact that respondents and those cited in many cases work together in the same lab or department and interact face-to-face.

The strength of ties in the intellectual-influence network was measured by asking the respondent to rate the extent of influence of each named scientist. Over one-half of those named were rated as having `great' influence. Almost sixty percent of the intellectual influences have worked together with the scientists investigated in the same organization in the Soviet Union. This suggests that scientific influence which is supposed to have no boundaries was in this case concentrated not only nationally but also localized on the institutional level.

Homophily

Homophily is the degree of similarity between a scientist and the colleagues he/she names as intellectual influencers or professional supporters. Homophily can refer to scientific specialty, status, work organization, and nationality or country of origin.

Scientists comprising the intellectual-influence network are described as more similar to respondent in terms of scientific specialty and area of research than those in the professional-support network. Most were former teachers and superiors, while the professional-support network is mostly composed of colleagues. Intellectual influence entails more status discrepancy and hierarchical relationships, while assistance is received mainly from one's peers.

When dealing with immigrant scientists the degree of homophily of respondents' and network members' national origin is significant. Over one-half (52.5%) of scientists listed in the intellectual influence networks were from the former Soviet Union. In principle scientific ideas and knowledge may be exchanged across borders of any kind and tend to spread globally. We note, however, that in the present case intellectual influence was constrained by geo-political boundaries and was concentrated to a large extent within the former Soviet Union. A striking example of this closure is that 93 percent of the sampled scientists reported that they have never participated in a professional conference outside the USSR and the Eastern bloc before migrating to Israel.

The support networks are comprised of almost equal shares of immigrants from the former Soviet Union and local Israeli scientists (36.6% and 35% respectively). The Russian colleagues from whom professional support is obtained are former Soviet scientists who immigrated to Israel in the second half of the 1970's. These so called 'veteran immigrants' serve an important linking function for their 'new immigrant' colleagues by providing a bridge between them and the local scientific community, and in many cases also to scientists abroad.

Comparison of Properties and Contents of Networks and Ties

Structural Property	Intellectual Influence	Professional Support
Size	Same	Same
Range	Wider	Narrower
Density	Looser	Closer
Intensity	Mixed (weak and strong)	Stronger
Homophily:		
specialty	greater	smaller
status	different	similar
nationality	homogeneous	heterogeneous
Contents		
	Intellectual	Professional
	Cognitive	Technical
	Informational	Instrumental

Channels of Influence and Resources of Support

Up till now I compared the structure of intellectual-influence and professional-support networks of immigrant scientists ignoring the substance or contents of what is transmitted through these ties.

I. As noted above, what is transmitted through the intellectual collegial network ties is mainly of a cognitive nature C ideas, information, knowledge, paradigms, models, and the like. The main interest therefore, in reference to this type of network, has to do with the kind of channels through which these resources flow.

Respondents were asked to indicate for each name they mentioned as having influenced their research, the communication media through which this influence was exerted :

1. Publications (by the named scientist)
2. Preprints and prepublished materials
3. Conference presentations and public lectures
4. Telephone calls
5. Informal discussions
6. Letters
7. E-mail
8. Fax
9. Rumors

In science, as expected, the most frequently noted channel of influence is publications ; eighty-two percent said that intellectual resources are transmitted by reading network members' published work (1). Almost two-thirds noted that they had personal discussions with influencers (5). Less than thirty percent mentioned conference presentations as channels of influence (3).

I examined whether different channels of communication are structured in a certain way. For this purpose the correlations matrix of influence channels was analized using Smallest space Analysis (SSA). [Smallest space Analysis (SSA) is a nonmetric scaling multidimensional technique in which intercorrelations among all variables are made visually accessible by presenting them as points in a geometric map in which spatial closeness corresponds to high correlation].

The spatial display (Figure 1) shows that the points representing different types of influence channels are plotted in different regions. The region below the lower line includes two items C publications and conference presentations C which are the most impersonal and public channels of knowledge transmission. Moving up, the section between the lower and higher line includes less impersonal channels, such as preprints and prepublished materials, and information about a scientist's work obtained through a third party. The upper region shows the most personal and private kinds of channels in which there is direct contact between influencer and influencee, namely face-to-face conversations and discussions, telephone calls, and personal correspondence.

II. The professional-support network is composed mainly of local colleagues who helped and supported the new immigrant scientist professionally. Scientists were asked to name other scientists who assisted them by providing the following resources :

1. Familiarizing them with the university in which they work
2. Teaching them to use new research methods and equipment
3. Finding a job or recommending them to potential employers
4. Helping in writing research proposals
5. Creating contacts to local Israeli scientists
6. Creating contacts to scientists outside Israel

7. Sending them to professional training courses
8. Helping to get their research results published.

The different items of professional support fall into two regions. The left side of the map includes instrumental-technical support items C help in writing a research proposal, teaching how to use equipment, training or upgrading courses etc. The other category of resources is depicted in the diagram's right side and pertains to relational aspects (`ties to ties'), such as helping find a job, establishing contacts with other scientists in Israel and abroad, connections with academic institutions, etc. In the case of immigrant scientists, besides instrumental and technical support, help in building networks of associations and establishing ties are a major resource for their integration into the local and international scientific community.

Summary

To summarize, intellectual influence and professional support networks as delineated by the scientists studied, differ in terms of their structural attributes. The intellectual collegial network constitutes a fragmented, low-density, long distance, and mixed high and low intensity network ; whereas the links in the professional support network are more concentrated, densely knit, close and intense. The substance and resources that are exchanged through these different networks correspond to this classification : what flows through ties of the intellectual influence network is mainly information and ideas, while the resources transmitted via the professional support network are much more instrumental, material and down to earth.
From a practical point of view it seems that Russian immigrant scientists, at least those currently employed in universities, receive professional assistance from rather tightly- knit networks of local Israeli colleagues (including veteran Russians) with whom they work and interact. The development of more far reaching intellectual collegial ties, which are vital in science, is more problematic. In general, the range of these networks before migration was limited to other scientists within the former USSR with very little cross-national contacts. Since scientific research in Israel is strongly oriented toward Western centers of science, Russian immigrant scientists will have to pursue intellectual connections with new colleagues in Israel and the West. In this respect local Israeli and veteran Russian scientists perform an important bridging function to other national and international communities of science. In the long run intellectual influence ties, their density and diversification, will become more important because they are the main channels through which scientific information is acquired and exchanged. Furthermore, immigrant scientists will learn new techniques and norms of doing science, and thereby become less dependent on professional assistance from colleagues in their immediate environment.