Expanding the Social Frame of Knowledge: Interdisciplinary, Degree-Granting Fields in American Colleges and Universities, 1975–2000

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While departments and disciplines continue to be the foundational organizational structures in colleges and universities (Abbott, 2002), the growth of interdisciplinary research and teaching is now widely recognized as a notable feature of academic change over the last 30 years. Research has shown both a sharp increase in interdisciplinary collaborative research (Javits & Grimes, 2006) and growing investments by national science agencies, states, and universities in interdisciplinary research (Brint, 2005; Geiger & Sa, 2005). The new interdisciplinary directions have articulate advocates in academe (see, e.g., Crow, 2002; Duke University, 1988; University of Southern Cali-

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fornia, 1998); and prestigious national organizations have begun to produce a literature of "best practices" to facilitate interdisciplinary organization (AAU, 2005; NAS, 2004). The new environment supporting interdisciplinary work has influenced the value faculty members place on different forms of knowledge. In the 1960s and early 1970s, professors identified primarily with the intellectual projects of their disciplines (Blau, 1973, chap. 8; Jencks & Riesman, 1968, chap. 1). Today, professors are far more likely to say that interdisciplinary knowledge is better than knowledge obtained from a single discipline (Gross & Simmons, 2007).

Interdisciplinary work has a long history in many disciplines, including education, gerontology, feminist studies, organization studies, and public policy (Abbott, 2002; Geiger, 1993; Slaughter, 1993). Since the 1980s, state and private funding for interdisciplinary work has flowed into the natural and applied sciences (Brint, 2005; Slaughter & Leslie, 1997; Slaughter & Rhoades, 1996). Because the applied sciences are the primary recipients of external support, many higher education scholars have focused on changes in the funding and organization of science as the primary causes of growing interest in interdisciplinary work (see, e.g., Etzkowitz, Webster, & Healey, 1998; Feller, 2005; Geiger, 2004; Gibbons et al., 1994; Nelson, 1993; Porter & Malone, 1992; Powell & Owen-Smith, 1998; Sa, 2006; Stehr & Weingart, 2000). Others have argued that external funding of the applied sciences has not been the cause of growing commitment to interdisciplinary work but rather has turned attention away from the long history of researchers engaged in interdisciplinary projects located at a greater distance from the market (Slaughter, 1993; see also Geiger, 1993; Slaughter & Leslie, 1997; Slaughter & Rhoades, 1996).

Implicitly challenging both of these interpretations, Brint (2005) emphasized the combined force of efforts to promote technological innovation *and* social incorporation. In the arts, humanities, and social sciences, he argued, demographic and cultural changes encouraging the incorporation of underrepresented populations (women, minorities, and non-Western peoples) have strongly influenced the growth of interdisciplinary activities. Some industry influences are also apparent in these fields, particularly that of the entertainment industry through digital arts, experimental performance arts, and cultural studies programs. Brint argued further that university leaders developed an ideology in the 1980s and 1990s that brought these two sources of change under the same conceptual roof. This ideology stressed the importance of "creating the future" through programs encouraging both economic and social innovation. Other scholars have interpreted these developments as reflecting the increasing integration (or "embeddedness") of universities in economy and society (Ramirez, 2006).

This paper focuses on one part of the larger picture of interdisciplinary change on campus: the growth and distribution of interdisciplinary, degree-

granting programs for undergraduates. Consistent with developments noted by others (see, e.g., AIS, 2007; Edwards, 1996; Klein, 1996), we found that these curricula have grown substantially during the 25-year period of the study, far outstripping the rate of growth in student enrollments. We found further that emphases on new technology development are relatively unimportant in this domain, while emphases on the incorporation of under-represented groups are very important (see also Boxer, 1998; Gates, 1992; Karen, 1991; Rojas, 2007; Stimpson & Kressner Cobb, 1986).

Thus, not only do the sources of interdisciplinarity vary by disciplin-ary domain (i.e., arts versus sciences), as Brint (2005) argued, but forms of institutionalization also appear to vary by disciplinary domain. In the natural and applied sciences, graduate umbrella groups and interdisciplinary research centers are primary vehicles of institutionalization (Brint, 2005; Feller, 2005; Geiger, 2004). Our findings suggest that the introduction of new undergraduate curricula may, in contrast, play a comparatively larger role in the development of interdisciplinary work in the arts, humanities, and social sciences (see also Frank, Schofer, & Torres, 1994; Levine & Cureton, 1992; Oakley, 1997).

The first part of the analysis focuses on patterns of growth between 1975 and 2000. We focus both on the total number of interdisciplinary programs and on growth in each of nine large program areas. These program areas, in order of their frequency of representation, are: (a) non-Western area and cultural studies; (b) race and ethnic studies; (c) Western area and cultural studies; (d) environmental studies; (e) international relations/global studies; (f) civic/governmental studies; (g) women's studies; (h) American studies; and (i) brain and biomedical sciences. The findings show that growth has been substantial over the period but is distributed in a highly uneven way among fields. The socially incorporative fields (non-Western studies, race and ethnic studies, and women's studies), the globally inclusive field of international relations/global studies, and the two science-based categories (environmental studies and brain and biomedical science) grew rapidly during the period. The other program areas have grown more slowly or have stagnated.

Drawing on the work of social power theorists, such as Pierre Bourdieu and Max Weber, higher education scholars have argued that power and contestation are endemic to the embedding of new knowledge within aca-demic institutions (see, esp., Etzkowitz, 1989; Geiger, 2004; Slaughter, 2002; Slaughter & Leslie, 1997; Slaughter & Rhoades, 1996, 2006). Following the lead of these scholars, our analysis of the growth and distribution of inter-disciplinary programs is based on the assumption that the introduction of new fields typically involves the identification and mobilization of new interests and opportunities, resistance by those who have a stake in existing

structures, and contestation between coalitions of interested parties. This pattern has been particularly marked in the fields of race and ethnic studies (Gates, 1992; Rojas, 2007) and women's studies (Boxer, 1998; Stimpson & Kressner Cobb, 1986). Often advocates of socially incorporative curricula gain a foothold on campus only after vigorous contestation for curricular space. However, this pattern has been evident in the development of new fields in the natural sciences (Etzkowitz, 1989; Greenberg, 2001) and social sciences (Haskell, 1979; Silva & Slaughter, 1984) as well.

FOUR EXPLANATORY HYPOTHESES

Within this context of struggle over curricular space, social scientists have proposed several explanatory frameworks for understanding the institutionalization of new fields on college and university campuses. We have not attempted to develop a conflict theory of curricular change to apply to these data, because we have no direct way to measure the relative power or hegemony of interested groups on the campuses in our sample or the level of political mobilization of these groups. However, we do lay out assumptions about organizational and group interests in our discussion of two of the four frameworks: those based on organizational stratification and socio-demographic composition. In addition, because one effect of power is to set the terms of legitimacy (Mann, 1986, chap. 1), we address issues of legitimacy in our discussion of the neo-institutional theory of diffusion. In the second part of the analysis, we compare the explanatory power of four of these frameworks.

The first is a diffusion framework. Diffusion models explain change as a function of the efforts of organizations to improve stability and effectiveness. Innovations that improve stability and effectiveness tend to spread through personal networks (Coleman, Katz, & Menzel, 1957) and organizational fields (Rogers, 1962). Neo-institutionalism is the most popular current form of diffusion theory in organization studies. It takes the position that organizations will adopt innovations that improve their legitimacy by conforming to dominant models in their environments (DiMaggio & Powell, 1983, 1991; Meyer et al., 1979; Schofer & Meyer, 2005). Legitimacy can be conferred on models that appear to improve organizational responsiveness to important constituency groups, as well as those that appear to improve efficiency or organizational rationality.

The second is a socio-demographic framework. Socio-demographic models explain change as an outcome related to the representation of new constituencies on campus (Slaughter, 1997, 2002; Smelser, 1994). Such models lead to the expectation that higher proportions of women, minorities, and/or international students can, following mobilization, lead to new

programs responsive to the interests of these groups. Sociologists who favor these models do not argue that socio-demographic change automatically translates into organizational change. Instead, student numbers must first be interpreted as a potential source for change and then must be sufficiently activated to give rise to powerful demands for change (see, e.g., Gates, 1992; Karen, 1991; Rojas, 2006, 2007; Smelser, 1994).

The third is an organizational stratification framework. Organizational stratification models explain change as a function of the unequal adoption of innovations due to inequalities in organizational resources, market power, or prestige of consumers (Kraatz & Zajac, 1996; Pfeffer & Salancik, 1978; Polodny, 1993). We assume that financial resources and status are the primary scarce values over which colleges and universities compete (see, e.g., Clotfelter, 1996; Ehrenberg, 2000, chap. 4; Jencks & Riesman, 1968, chap. 1). Status can be either intellectual or social, though intellectual status has been more important since the 1960s, in large part because it has become a politically and socially legitimate way to maintain and expand the financial health of academic organizations in the long term.[1] Interdisciplinary programs may be associated with more prestigious locations in academe because of their reputations for generating avant-garde or "cutting-edge" ideas and therefore attracting intellectually creative students and faculty (Brint, 2005). However, because social status continues to be a factor in academe, organizational stratification can at times work in the opposite way as well; programs associated with lower-status populations can be interpreted as having diminished institutional status and therefore become less popular in elite than in non-elite institutions. (For an example of this process in an earlier period, see Karabel, 2005, chaps. 3–4.) As in the case of student numbers, organizational interests in resources and status must be interpreted as legitimate and activated politically to create organizational change.

The fourth is an organizational ecology framework. Most ecological frameworks explain the behavior of organizations as an adaptation to the structure of the organizational field, including both constraints imposed by other organizations and open niche spaces that offer opportunities (see, e.g., Carroll, 1988; Hannan & Freeman, 1977). Our approach to organizational ecology is slightly different in that our primary focus is intra-institutional, rather than inter-institutional (Olzak & Kangas, 2007). We focus on the ecological conditions created by the existing structure of the organization itself. These conditions include, for example, the size of student enrollments under the assumption that larger enrollments create a critical mass of students (and faculty) to support new programs. They also include pre-existing

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[1]For histories of the rise of "meritocracy" in elite institutions, see Karabel, 2005; Lehman, 1999; Jencks & Riesman 1968, chap. 1.

curricular emphases, such as high proportions of students majoring in the arts and sciences rather than in occupational-professional fields.

In the second analysis, we show that organizational ecology variables—notably, enrollment size and the proportion of arts and sciences to total degrees—are strongly associated with both the total number of undergraduate interdisciplinary programs, and interdisciplinary programs in most of the nine major program areas we investigate. Panel year, our indicator of diffusion, shows a significant net association with socially incorporative programs, indicating that the existence of these programs may enhance the willingness of institutions to add more such programs. In addition, the proportion of women students has an influence on the growth of socially incorporative programs. The analysis provides little additional support for socio-demographic explanations of the growth of interdisciplinary programs and very little support for explanations based on organizational stratification.

In the conclusion of the paper, we discuss the implications of our findings for understanding interdisciplinary change in academe.

DATA AND METHODS

The term "interdisciplinary" is used most frequently to describe the programs in which we are interested, but some institutions use the terms "multidisciplinary," "trans-disciplinary," "interdepartmental," or "cross-departmental." For purposes of classifying programs, we treat these labels as interchangeable. These labels have been subject to considerable discussion among partisans of different approaches to integrative and interdisciplinary studies (Klein, 1996).

We define undergraduate interdisciplinary programs as "degree-granting programs that draw on faculty from more than one academic department." We include programs that offer majors, minors, or both. We also require that colleges and universities identify these programs as interdisciplinary. We do not include programs that offer courses but no degrees.

Our analysis is based on counting programs that are typically organized as interdisciplinary units and excluding programs that are typically organized as departments. This distinction is necessary because some colleges and universities employ the interdisciplinary program designation as a managerial resource: to maintain struggling fields of inquiry without providing permanent resources, or to provide a transitional location for upwardly mobile fields. To count all interdisciplinary programs, regardless of their typical form of organization, would be to confound these managerial expediencies with the underlying phenomena in which we are interested. Nearly all academic fields (including, for example, chemistry, psychology,

and English) are organized in at least a few of our sample institutions as "interdisciplinary programs."

We have adopted the following criterion for judging whether a field is typically organized as an interdisciplinary program or as a department: we looked at the organization of fields as departments and programs throughout the period of our study. If the field was organized two-thirds or more of the time as an interdisciplinary program, we counted it as typically organized as an interdisciplinary program. With the exception of the borderline case of film studies,[2] those fields organized less than two-thirds of the time as interdisciplinary programs were not counted. Thus, we counted Latin American studies as an interdisciplinary field, because 96% of the Latin American studies units in our sample were interdisciplinary programs rather than departments. In contrast, we did not count classics as an interdisciplinary field, because 72% of the classics units in our sample were organized as departments rather than as interdisciplinary programs. The two-thirds criterion thus is a cautious designation, but it clearly differentiates fields such as geology, linguistics, and classics that are occasionally organized as interdisciplinary programs from those that are typically organized as interdisciplinary programs.

The College Catalog Study Database

Because our study is explicitly interested in change over time, we could not rely on cross-sectional directories of interdisciplinary programs (Newell, 1986; Edwards, 1996; AIS, 2007). The existing directories also use different criteria for identifying interdisciplinary programs.[3] Instead, the data for this paper come from the College Catalog Study (CCS) database, a unique data set on academic organization in American four-year colleges and universities.

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[2]Film studies programs (64% interdisciplinary) came within two percentage points of meeting the two-thirds criterion.

[3]The Association for Integrative Studies (AIS) provides online resources for interdisciplinary undergraduate and graduate programs, archives interdisciplinary course syllabi, and published the first edition of "Interdisciplinary Undergraduate Programs: A Directory" (Newell, 1986). The AIS (1986) directory of Ph.D. programs focuses on programs located within liberal arts and determines whether the program is to be included based on an evaluation of program websites and the degree to which programs integrate the knowledge of other disciplines into the requirements of the program. In an updated version of Newell (1986), Edwards (1996) employed different criteria for including interdisciplinary program than the criteria currently in use by the AIS for classifying doctoral programs. Edwards's criteria include: undergraduate focus, persistence over time, explicit and intentional orientation to approach subjects from an interdisciplinary perspective, and institutional recognition as an interdisciplinary program. Edwards mailed approximately 4,000 surveys and a follow-up. Many of the responses did not fit his criteria for inclusion in the directory. The directory ultimately included more than 400 program descriptions and has not been updated since 1995.

We selected the sample institutions for the College Catalog Study database from among those represented in the Institutional Data Archive (IDA) on American Higher Education. IDA is a database including more than 2,000 variables on 384 American colleges and universities covering a 30-year period, 1970–2000. The link to IDA allowed us ready access to a wealth of institutional data. The data in IDA is organized in a panel design, with entries coded at five-year intervals; the CCS database includes the same panels as IDA. Coding in CCS occurs in six target years: 1975–1976, 1980–1981, 1985–1986, 1990–1991, 1995–1996, and 2000–2001. In some cases, catalogs were not available for specific target years, either because they were published biannually or spanned more than one year. In these cases, we coded catalogs from the nearest available adjacent year.

To collect the data, we contracted with CollegeSource, Inc., a San Diego-based company specializing in the reproduction of college catalogs on microfiche. We coded every IDA institution in the CollegeSource collection for which complete microfiche existed, a total of 294 institutions.

Like IDA, the CCS database is a stratified random sample of comprehensive four-year colleges and universities in the United States. IDA does not include specialized institutions (such as art colleges, business colleges, and seminaries) and oversamples larger and more prestigious universities. While most four-year colleges and universities in the United States are small (under 4,000 students), small institutions enroll a low proportion of all students. In addition, larger and more prestigious institutions have the wealth and organizational capacity to respond to new developments. As Table 1 indicates, CCS and IDA institutions are larger than the norm for all four-year colleges and universities. The CCS and IDA samples also include higher proportions of research universities, of public institutions, and a somewhat lower proportion of religiously-affiliated colleges and universities.

We took a number of precautions to improve coding accuracy. Student coders were given detailed instructions on coding, with particular attention to the coding of potentially ambiguous data. Experienced coders were designated to provide advice on difficult decisions. In addition, the research team held regular meetings to discuss coding issues. Independent checks, based on complete recoding of institutions, were conducted on approximately 20% (56) of the sampled institutions. These independent checks were conducted on the larger and more complex institutions, and on those institutions whose catalogs were most difficult to interpret. Because of the checks and protections built into the process, we are confident that we obtained an acceptable level of accuracy in the coding of the college catalogs.

Dependent Variables

The total number of programs is defined as including only units typically organized as interdisciplinary. For fields that meet the two-thirds criterion

Table 1

College Catalog Study Sample Characteristics, 2000

	Institutional Data Archive Institutions (n = 384)	*College Catalog Study Institutions (n = 294)*	*All Four-Year Colleges and Universities (n = 1958)*
Public	45.1%	45.9%	27.9%
Religious	25.5%	27.6%	33.2%
Doctoral-granting universities	31.0%	32.7%	11.7%
Master's-granting universities	32.0%	32.7%	25.9%
Baccalaureate-granting colleges	36.5%	34.7%	30.4%
Specialized institutions[1]	NA	NA	32.0%
Coastal regions (West, New England, Mid-Atlantic)	39.3%	39.8%	39.6%

[1]Carnegie "specialized institutions" include art institutes, business colleges, military institutes, and seminaries.
Sources: Higher Education Directory (1999); College Catalog Study Database

that we established for classifying programs as typically interdisciplinary, we included both programs and departments in the analyses. The logic of our approach is based on the assumption that the defining feature of "interdisciplinary fields" is their typical form of organization, not that they are invariably organized as interdisciplinary programs. The proportion of departments counted is low—by definition, under one-third for each interdisciplinary field. (As Table 2 indicates, the proportion of departments is actually much lower in most cases.) we use the same procedure when analyzing each of the nine main interdisciplinary areas, counting only fields that are organized at least two-thirds of the time as interdisciplinary programs and including departments for fields that meet this two-thirds criterion.

Most dependent variables in our analysis are measured as binomial, where "1" indicates the presence of at least one program in the category. In these analyses, we were interested, first, in testing the power of variables drawn

TABLE 2

FIELDS TYPICALLY ORGANIZED AS INTERDISCIPLINARY PROGRAMS, 1975–2000

Program	Total	# Interdisciplinary Organization (Percent)	# Department Organization (Percent)
1. Non-Western Cultural Studies	**324**		
Asian area studies	132	114 (86%)	18 (14%)
Latin American area studies	112	107 (96%)	5 (4%)
African area studies	51	42 (82%)	9 (18%)
Middle Eastern studies	19	19 (100%)	0 (0%)
2. Race and Ethnic Studies	**250**		
African American studies	114	87 (76%)	27 (24%)
Race and ethnic studies	54	41 (76%)	13 (24%)
Chicano, Hispanic studies	41	27 (66%)	14 (33%)
American Indian studies	24	19 (79%)	5 (21%)
Asian American studies	17	14 (82%)	3 (18%)
3. Western Studies	**227**		
European, North American studies	153	138 (90%)	15 (10%)
Western period history studies	70	68 (97%)	2 (3%)
European origin studies	2	2 (100%)	0 (0%)
Western studies	2	2 (100%)	0 (0%)
Canadian studies	2	2 (100%)	0 (0%)
4. Environmental Studies	**215**	173 (80%)	42 (20%)
5. International/Global Studies	**204**		
International/global studies	152	132 (87%)	20 (13%)
Peace/conflict studies	40	38 (95%)	2 (5%)
Political economy	12	10 (83%)	2 (17%)
6. Civic/Governmental Studies	**194**		
Urban studies	99	87 (88%)	11 (12%)
Public affairs, public policy	48	37 (77%)	11 (23%)
Legal studies	47	38 (81%)	9 (19%)
7. Women's Studies	**192**	173 (90%)	19 (10%)
8. American Studies	**158**		
American culture/studies	142	123 (87%)	19 (13%)
U.S. regional studies	16	16 (100%)	0 (0%)
9. Brain and Biomedical Science	**124**		
Cognitive, neuroscience	66	50 (76%)	15 (24%)
Biological psychology	21	17 (81%)	4 (19%)
Biomedical, biotechnology	19	18 (95%)	1 (5%)
Medical technology	18	12 (67%)	6 (33%)

Table 2, cont.

Program	Total	# Interdisciplinary Organization (Percent)	# Department Organization (Percent)
10. Other	**387**		
Interdisciplinary studies[1]	106	98 (92%)	8 (8%)
Film studies	66	42 (64%)	24 (36%)
Liberal studies	57	50 (88%)	7 (12%)
Gerontology	43	39 (91%)	4 (9%)
Judaic studies	41	39 (95%)	2 (5%)
Science and society	22	19 (86%)	3 (14%)
Arts management	13	13 (100%)	0 (0%)
Health management	10	10 (100%)	0 (0%)
Folk studies	9	6 (67%)	3 (33%)
Ethics, values	5	5 (100%)	0 (0%)
Sexuality studies	5	5 (100%)	0 (0%)

[1] A small number of programs were listed twice in catalogs, both as interdisciplinary programs and as departments.
Source: College Catalog Study database

from the four explanatory frameworks on the existence of programs in each of nine program areas. In the subsequent analysis, we examined the total number of interdisciplinary programs in institutions using a simple count of programs as the dependent variable.

Table 2 provides a list of fields in our sample that are typically organized as interdisciplinary programs. The count includes every program in these fields that existed at any time during the period. All fields in Table 2 fit the criterion that they are organized as interdisciplinary programs rather than departments at least two-thirds of the time. The table includes our classification of these fields into either one of the nine large categories or a tenth category labeled "other interdisciplinary." Although race and ethnic studies and women's studies programs are both socially incorporative and closely associated in their origins, with social movement activity (see, e.g., Boxer, 1998; Moses, 2000; Olzak & Kangas, 2007; Rojas, 2006, 2007; Turk-Bicakci, 2007), they have distinctly different histories. (See Boxer, 1998, for women's studies; and Rojas, 2007, for African American studies). We consequently classified race and ethnic studies and women's studies programs separately.

In our statistical analysis, we adjusted for programs that were eliminated, absorbed into departments, consolidated, or split into two. We no longer included programs that were eliminated or absorbed into departments after their change in status. We counted consolidated programs once, rather than twice, following consolidation. We counted programs that split twice, fol-

lowing the split. A number of programs were eliminated or absorbed into departments during the period of study. In addition, consolidations were approximately three times more common than splits. For these reasons, the number of programs in our statistical analysis is lower for each of the six target years than the number of programs reported in Table 2. We excluded one institution, California Institute of Technology, from the analysis, because it was an outlier in the number of interdisciplinary programs it sponsored, in operating budget per student, and in average SAT scores of entering freshmen.

Independent Variables

The independent variables in our analyses are derived from the four explanatory frameworks discussed above.

We used growth in the number of adopting institutions during the period (DIFFUSE) as our measure of diffusion. In the analysis, we identify the presence of the nine categories of programs at each institution. Positive coefficients for DIFFUSE indicate that an increasing number of institutions were offering a program in the category under consideration over the 25-year period. DIFFUSE is a measure of the spread of programs across institutions, rather than of the simple growth of the number of programs.

We included two socio-demographic variables in the analysis. The first is female enrollments as a proportion of the total undergraduate enrollment (PCTFEM). The second is minority enrollments as a proportion of the total undergraduate enrollment (PCTMIN).

We included four measures of organizational stratification in the analysis. Each focuses on a different dimension of status in academe. The first organizational stratification measure is the Carnegie Classification of doctoral-granting universities, where doctoral-granting institutions are dummy coded as "1," and other institutions are coded "0" (DOCTORAL). The second organizational stratification measure is control (PRIVATE), where private institutions are coded "1" and public institutions are coded "0." The third organizational stratification measure is operating budget per student, a standard measure of financial resources (OPBUDSTD). We used the Consumer Price Index to adjust OBSUDSTD to 2000 dollars. We also examined average entering SAT/ACT scores for freshmen, but dropped this variable from the final analyses because of its very high correlation with OPBUDSTD and because of limitations in using SAT/ACT scores due to missing data.[4]

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[4]Because SAT/ACT and OPBUDSTD (adjusted for 2000 dollars and logged) were correlated ($r > .80$ in every year for which data are available), we used only OPBUDSTD in these analyses. High correlation among independent variables can cause numerical imprecision, less stable coefficient estimates, higher standard errors, and less powerful statistical tests. OPBUDSTD is the better measure of institutional prestige: in IDA, SAT is missing for 1985, 1990, and 1995 and for several sample institutions (32 in 1999 and 17 in 1977 and 1982).

We included three organizational ecology measures. The first is total enrollment (ENROLL). We use total enrollment as our measure of size, because graduate students are a factor in the capacity of institutions to offer new academic programs. We interpret ENROLL as a measure of the capacity of an institution to support a critical mass of students interested in a new field. The second ecology variable is liberal arts and sciences degrees as a proportion of the total degrees awarded (PCTLIB). PCTLIB measures the proportion of baccalaureate degrees in fields of arts and sciences, such as English, history, economics, sociology, biology, chemistry, and physics. We compare degrees in arts and sciences with degrees in occupational-professional fields, such as engineering, nursing, and business administration. We interpret PCTLIB as a measure of the receptivity of the environment to new programs connected to "basic" as opposed to "applied" fields. The third ecology variable is region (REGION). REGION is a dummy coded variable and measures whether an institution is located in a comparatively liberal region of the country: New England, the Mid-Atlantic States, or the West Coast. Location in these regions is coded as "1." Because these regions are characterized not only by political liberalism, but also by greater social diversity, we hypothesize that they may be associated with greater receptivity to interdisciplinary programs.

We also included one control variable, a measure of whether the institution had a program in the interdisciplinary field under investigation at t-1. This variable (PAST) is necessary to control for the tendency of academic programs to persist once founded (see, e.g., Gumport 2002).[5]

Table 3 provides information about the independent variables we included in the analysis. The data set includes 33 records (of 1,764) containing missing data. Some of these missing data comes from institutions that did not exist until later years in the time period and some from missing data on OPBUDSTD.

Analytical Methods

Analyses of growth are based on simple counts of interdisciplinary programs across time. In the subsequent multivariate analyses, we investigate

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[5]We were unable to determine whether programs existed in 1970–1971, because most CollegeSource catalogs were collected beginning in the mid-1970s. We had the choice either to drop 1975 as a panel, or to impute values for 1975 based on 1975 (rather than 1970) programs. PAST is a control variable, so the imputation is not central to our analysis. Nevertheless, we ran analyses a second way, dropping data from 1975 except as a measure of the control variable PAST. In these models, DIFFUSE became insignificant in the cases of non-Western area studies and international relations. PCTFEM became significant for American studies and PCMIN became significant (as a negative covariate) for civic/governmental studies. We interpret these differences in results as marginal, and we therefore report data from all six panels to maximize use of the collected data.

TABLE 3

DESCRIPTIVE STATISTICS ON INDEPENDENT VARIABLES, 2000–01

A. Continuous Variables

	Minimum	Maximum	Mean	St.Dev.	N
Percent women	0	100	57.7	11.1	294
Percent minority	3.5	100	28.7	19.7	294
Ave. SAT/ACT	850	1485	1114.3	132.9	294
Total enrollment	372	51390	9175.1	10207.8	294
Operating budget/ student	3422.4	175505.7	24917.4	25840.4	294
Percent arts & sciences degrees	6	100	49.9	24.7	294
No. interdisciplinary programs	0	30	5.2	5.0	294

B. Categorical Variables

	Frequency	Percent of Total	N
Doctoral university	96	32.7	294
Private college/ university	159	54.1	294
Coastal region	117	39.8	294

Source: College Catalog Study Database

the presence of programs in each of nine fields and the total number of programs, using variables drawn from the four explanatory frameworks. In these analyses, we use the general estimating equation (GEE) with fixed effects (Haldin & Halbe, 2003; Littel, Stroup, & Freund, 2002). GEE is a generalization of the linear model in which the distribution of the dependent variable can take a variety of forms, and the link between the dependent variable and the set of independent variables can be manipulated. GEE allows for repeated measures of the variables and the modeling of correlation of residuals within institutions across time.

For the analysis, we define the first nine models with a binomial distribution and a logit link function with an autoregressive correlation structure. Autoregressive correlation describes the expectation that correlation within each institution from one time period to the next will become exponentially

weaker over time.[6] Using GEE, we seek to explain changes in the presence of the nine interdisciplinary areas between 1975–1976 and 2000–2001, and the major influences on the presence of these programs over time for this set of colleges and universities. We use the same modeling approach for the analysis of the total number of programs on campuses over time. Here we model a negative binomial distribution because of the large number of institutions with few or no interdisciplinary programs.[7]

We conducted analyses using both weighted and unweighted data. Because the CCS data closely approximate the IDA sample (see Table 1), we applied weights based on the institutions represented in IDA's stratified random sample.[8]

Results

We present the results of our analysis in two sections corresponding to our interest in both the growth and the distribution of interdisciplinary programs over the 25-year period of our study. The first section presents findings on the growth of interdisciplinary programs. The second section presents findings on the distribution of interdisciplinary programs. We examine this distribution using the four explanatory frameworks described above.

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[6]The autoregressive structure of the correlations is based on an assumption that the correlation of residuals between time 1 and time 6 will be weaker than the correlation of residuals between time 1 and time 2. We chose the autoregressive structure for substantive reasons. In our view, the autoregressive structure is preferable to an exchangeable error structure (i.e., constant correlations between residuals), because broad secular trends in the institutional environment can be expected to influence campus level events. Nevertheless, as a precaution, we ran models based on three other assumptions about error structure—AR (1), exchangeable, and independent—with no major changes in model fit. GEE is robust against mistakes in assumptions about error structure, so long as the assumptions are approximately accurate.

[7]We modeled a negative binomial distribution, rather than a Poisson distribution, because the mean and the variance of the dependent variable are not equal. Basic findings are unchanged when the model is based on a Poisson distribution. PCTFEM becomes a less strong predictor and is not quite significant at $p < .05$.

[8]Weights were determined by the proportion of institutions coded within each of four strata of American colleges and universities: elite colleges and universities (18.8% of the IDA sample), other selective colleges and doctoral-granting universities (28.4% of the IDA sample), master's-granting institutions (26.8% of the IDA sample), and other bachelor's-granting institutions (26.0% of the IDA sample). Specialized institutions, such as art schools, music schools, and business colleges are not included in the population used for purposes of weighting (Brint, Turk-Bicakci, Riddle, & Levy, 2003). Findings based on weighted and unweighted data differed little. In this paper, we present findings based on the weighted data to reflect better the population of higher education institutions in the period 1975 to 2000.

Growth of Interdisciplinary Fields, 1975–2000

Based on the two-thirds criterion, the total number of interdisciplinary fields in our sample institutions grew by nearly 250% between 1975 and 2000: from 674 programs in 1975-1976 to 1,663 in 2000-2001. In contrast, enrollments at our sample institutions grew from 2.14 million in 1975 to 2.52 million in 2000, a growth rate of 17.8%. Thus, the growth of interdisciplinary fields during the period is not simply a function of enrollment growth.

Each of the nine large interdisciplinary areas grew over the period, but rates of growth were unevenly distributed across fields. The number of interdisciplinary units in international relations/global studies, women's studies, and brain and biomedical science more than tripled over the time period. The number of programs in environmental studies nearly tripled over the period, and the number of programs in non-Western studies, and race and ethnic studies more than doubled. These six can be considered the high growth areas. Western studies also showed strong growth, nearly doubling in number, but civic/governmental studies and American studies grew more slowly. Indeed, the number of American studies programs barely grew over the period.

Thus, the trend data show a marked shift from Western-oriented to global and socially incorporative programs. The trend data also show strong growth in two science-based fields: environmental studies and brain and biomedical studies.

Distribution of Interdisciplinary Programs, 1975-2000

We report the results of our analysis of the distribution of interdisciplinary programs in Tables 4 and 5.

Table 4 shows the significant net predictors of interdisciplinary programs in each of the nine large interdisciplinary fields. The findings indicate that our two organizational ecology variables--the percent of arts and sciences degrees and enrollment size—were the most consistent predictors of having interdisciplinary programs in the nine program areas. PCTLIB showed a significant net effect in eight of the nine interdisciplinary program areas and ENROLL showed a significant net effect in six. Our measure of the broader environment, REGION, showed borderline statistical significance ($p < .10$) in three program areas (non-Western area studies, Western area studies, and American studies).

Programs in socially incorporative fields appear to provide legitimacy for colleges and universities. DIFFUSE, our measure of diffusion, showed significant net effects on the existence of programs in women's studies, race and ethnic studies, non-Western studies, environmental studies, and international relations/global studies. In contrast, U.S. and Western-oriented programs (American studies, Western studies, and civic/governmental studies) showed no signs of diffusing in a consistent way during the 25-year period.

FIGURE 1. GROWTH RATES OF NINE LARGE INTERDISCIPLINARY FIELDS, 1975–2000
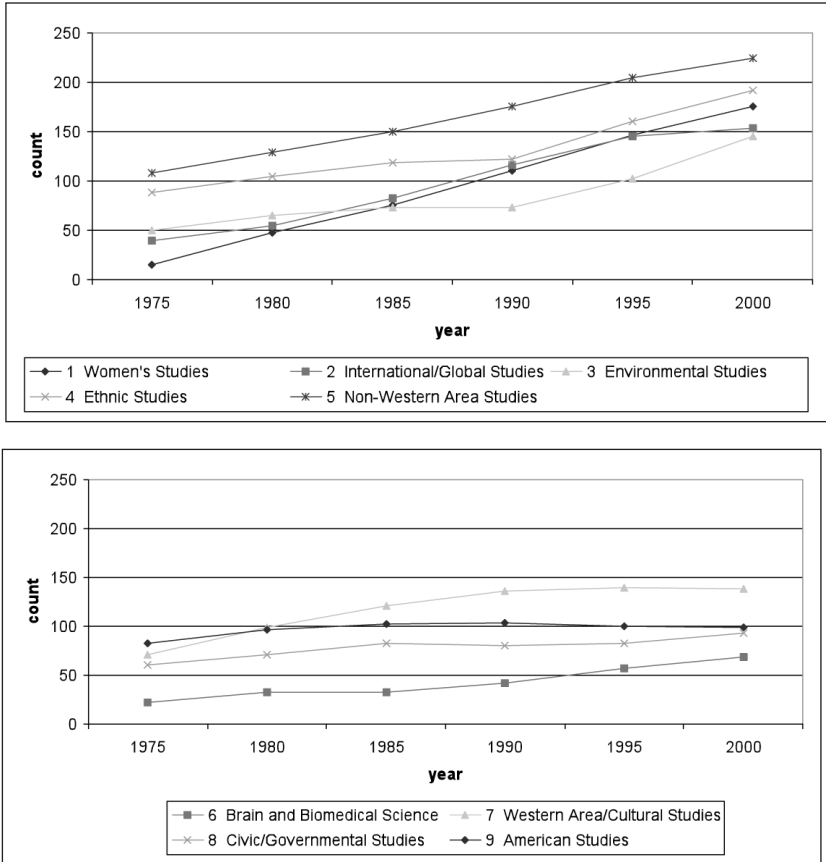
Source: College Catalog Study Database

Variables measuring campus demographic composition showed relatively few statistically significant effects in these models. The percent of women on campus was significantly related to the adoption of women's studies programs, but was otherwise insignificant. The percent of minority students on campus was negatively related to two U.S. and Western-oriented interdisciplinary fields (American studies and Western studies). It was also negatively related to environmental studies. Otherwise, it showed no significant net effects in our models. Organizational stratification variables also showed little explanatory power, with the following exceptions: (a) OPBUDSTD was

TABLE 4

DISTRIBUTION OF INTERDISCIPLINARY PROGRAMS, 1975–2000

A. Diffusing Programs

	Nonwestern Cultural Studies (B/St.Err.)	Race & Ethnic Studies (B/St.Err.)	Environ-menal-Studies (B/St.Err.)	International Relations/ Global Studies (B/St.Err)	Women's Studies (B/St.Err.)
Intercept	-16.6*** (2.9)	-12.8** (3.5)	-9.0*** (2.6)	-9.8*** (2.4)	-19.9*** (2.8)
Existence of program in t-1	6.0*** (.32)	6.1*** (.36)	5.6*** (.34)	5.2*** (.29)	6.6*** (.81)
Diffusion	.21* (.09)	.25** (.08)	.37*** (.08)	.18** (.06)	.42*** (.07)
Percent liberal arts/sciences	.03*** (.01)	.03*** (.01)	.01** (.00)	.02** (.01)	.02*** (.01)
Enrollment size	.76*** (.21)	.84*** (.20)	.16 (.14)	.34** (.14)	.97*** (.15)
Percent female enrollment	-.01 (.01)	.01 (.01)	-.00 (.00)	.00 (.01)	.03*** (.01)
Percent minority enrollment	-.12 (.17)	.23 (.17)	-.30* (.14)	-.19 (.13)	-.28* (.12)
Operating budget/ student (in 2000 $)	.57* (.25)	.01 (.29)	.38 (.24)	.36 (.21)	.60* (.25)
Doctoral university (1 = doctoral)	-.43 (.42)	-.03 (.48)	.31 (.36)	-.21 (.32)	-.15 (.35)
Private college/ univ. (1 = private)	.17 (.37)	-.36 (.35)	.11 (.28)	.23 (.29)	-.06 (.29)
Region (1 = coast)	.49 (.28)	-.19 (.28)	.26 (.23)	-.10 (.23)	.37 (.22)
Corrected quasi-likelihood (QICC)	500.9	531.1	825.8	864.0	757.2

Table 4, cont.

B. Non-Diffusing Programs

	Western Studies (B/(St.Err.)	American Studies (B/St.Err.)	Civic & Govt. Studies (B/St.Err.)	Brain & Bio-medical Studies (B/St.Err)
Intercept	-17.2*** (3.1)	-8.15** (2.8)	-6.7* (2.8)	-9.5*** (2.8)
Existence of Program in t-1	5.5*** (.26)	5.4*** (.23)	4.9*** (.07)	4.9*** (.24)
Diffusion	-.002 (.08)	-.05 (.09)	.08 (.07)	.05 (.08)
Percent liberal arts/sciences	.02* (01)	01 (.01)	.02** (.01)	.02*** (.01)
Enrollment size	.66*** (.20)	.12 (.17)	.35** (.16)	.08 (.19)
Percent female enrollment	.02 (.01)	.01 (.01)	-.01 (.01)	.01 (.01)
Percent minority enrollment	-.52*** (.14)	-.27* (.11)	-.23 (.12)	-.21 (.12)
Operating budget/ student (in 2000 $)	.76** (.28)	.36 (.22)	.01 (.24)	.39 (.23)
Doctoral university (1 = doctoral)	.12 (.41)	.20 (.37)	.26 (.37)	.67 (.42)
Private college/ univ. (1 = private)	-.01 (.35)	-.23 (.29)	.05 (.26)	.59* (.29)
Region (1 = coast)	.48 (.28)	.45 (.24)	.18 (.23)	.22 (.22)
Corrected quasi-likelihood (QICC)	514.8	697.2	704.1	503.3

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* $p<.05$ **$p<.01$ ***$p<.001$
Source: College Catalog Study database

TABLE 5

DISTRIBUTION OF TOTAL CAMPUS INTERDISCIPLINARY
PROGRAMS, 1975–2000

	Programs/ Campus (B/St. Err)
Intercept (1.16)	-7.6***
Diffusion (.02)	.13***
Percent liberal arts/sciences	.02*** (.00)
Enrollment size	.49*** (.07)
Percent female enrollment	.01* (.00)
Percent minority enrollment	-.03 (.04)
Operating budget/ student (in 2000 $)	.29** (.10)
Doctoral university (1 = doctoral)	.12 (.18)
Private college/ univ. (1 = private)	.12 (.13)
Region (1 = coast) (11)	.25*

| Corrected quasi-likelihood (QICC) | -6735.6 |

* p<.05   **p<.01   ***p<.001
Source: College Catalog Study database

significantly associated with the existence of international program areas and with women's studies, and (b) private universities were more likely to adopt the new brain and biomedical fields.

Our control variable, the existence of a program in t-1, proved to be highly significant, as expected. Programs, once founded, tended to persist in all nine areas.

Table 5 shows the significant net predictors of the total number of units (programs and departments) in interdisciplinary fields. Analysis of the total number of programs per institution showed a similar pattern to the analysis of the nine specific interdisciplinary areas. We had no reason to control for persistence so we did not include the variable PAST in these analyses. EN-ROLL, PCTLIB, and DIFFUSE showed the strongest net effects, consistent with the results for the nine categories of programs. In the analysis of total programs, however, REGION also showed significant net effects, as did one measure of organizational stratification, OPBUDSTD. Variables measuring socio-demographic composition did not show significant net effects in the model. The other organizational stratification variables, DOCTORAL and PRIVATE, also did not show significant net effects. The results of this analysis suggest more than one line of support for offering interdisciplinary degree programs, including not only variables linked to organizational ecology, but also variables linked to organizational prestige. We know from the previous analysis that larger institutions focusing on arts and sciences are more likely to offer specific types of interdisciplinary programs. Wealthier institutions, whether due to capacity or faculty interests, are, in addition, more likely to offer a larger number of interdisciplinary programs.

DISCUSSION

This section discusses why interdisciplinary programs tend to be found at particular types of colleges and universities, but not at others. We will also discuss the under-appreciated role of the humanities and social sciences as generators of support for interdisciplinary activity on campus. The final point of discussion is why interdisciplinary fields have persisted and grown in recent decades, even though the foundational structures of colleges and universities remain department- and discipline-based. We conclude with an observation concerning future directions for research on interdisciplinary programs.

The Institutional Address of Interdisciplinary Fields

In the CCS data, we see that particular types of institutions have a propensity to offer interdisciplinary programs to undergraduates. During the period covered by our study, those interested in interdisciplinary programs were more likely to find favorable environments for expressing their interests if they worked in large, wealthy, arts and sciences-oriented universities on the East or West coasts. Our findings indicate that larger institutions and those that award most of their undergraduate degrees in arts and sciences provide the most favorable environments for the institutionalization of different types

of interdisciplinary studies. In addition, wealthier institutions, as measured by operating budget per student, tend to offer a larger total number of interdisciplinary programs and are more likely, in particular, to offer interdisciplinary programs in internationally oriented fields and in women's studies. Net of these more important covariates, neither campus demographic composition nor other indicators of campus financial strength or prestige appear to matter much for the development of interdisciplinary fields.

Why are organizational ecology variables so important? The likely causes have to do with organizational capacity and organizational propensity to support new fields. Capacity is related to critical mass. Larger institutions have the capacity to employ a critical mass of faculty to support new fields, and, equally, the potential for generating a critical mass of student interest in these fields. In addition, larger institutions have the capacity to experiment and perhaps also an incentive to offer "something for everyone" in their large and diverse student bodies. Propensity is related to preexisting curricular bases out of which interdisciplinary programs grow or gain support. Our data indicate that new interdisciplinary fields, at least in the undergraduate curriculum, grow primarily out of the arts and sciences disciplines, rather than the occupational-professional disciplines. We speculate that arts and sciences-oriented colleges and universities are more likely to attract faculty who are attuned to new movements in knowledge production, some of which take an interdisciplinary form.[9] Another ecological variable, the region surrounding institutions, may also influence their propensity to offer interdisciplinary programs. As compared to other regions in the United States, the coastal regions tend to be politically more liberal, socially more diverse, and more closely connected to "new economy" industries (Florida, 2002). We speculate that these characteristics attract faculty and administrators who are receptive to programs related to social and economic change. Additional research will be necessary to determine whether political culture, social diversity, or "new economy" industries (or some combination of the three) explain the regional effects we found, or if other characteristics of these regions are responsible for these findings.

The Role of Humanities and Social Sciences

Much scholarship on interdisciplinary change in academe has focused on the role of the natural and applied sciences in new technology development. Yet campus administrators have often taken a more expansive view of op-

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[9]Unreported analyses suggest that preexisting interdisciplinary programs may be another ecological factor associated with the development of new interdisciplinary programs. We interpret this result as perhaps indicative of variably supportive environments in which these new "species" have a greater or lesser chance of propagating. We do not report the analyses, because the index of preexisting interdisciplinary programs is highly correlated with size of enrollments.

portunities for the development of interdisciplinary fields. Duke University, the first university to embrace interdisciplinary research and teaching as an explicit strategy of intellectual advance, sought to build on the renown of its highly interdisciplinary comparative literature department (Duke University, 1988). In the 1990s and 2000s, proponents of interdisciplinary work on campus frequently advanced the idea that interdisciplinary work is an important contributor both to technological and social progress (Brint, 2005). Thus, one prominent advocate, Michael Crow (2002), president of Arizona State University, wrote: "The traditional disciplinary organization of universities may not be the optimal way to organize the institution itself or to teach students to solve . . . social, economic and technological challenges. . . . Accordingly, we encourage teaching and research that is interdisciplinary" (p. 20). Historically, international relations and area studies programs have been very important sources of interdisciplinary programs. These fields have little to do with new technology development but were sponsored by foundations and the federal government to broaden understanding of strategically important regions of the world (Clotfelter, 2005; Goodwin & Nacht, 1994).

Undergraduate interdisciplinary programs are only a small part of the larger picture of interdisciplinary change on campus. Nevertheless, because they are explicitly identified in college catalogs as study options, have administrative resources attached to them, and typically persist once established, these programs can be considered a well-institutionalized feature of academe. Our findings provide support for those who see globally oriented programs and programs of social incorporation as important supports for interdisciplinary teaching and research in American colleges and universities. Our analysis indicates that interdisciplinary programs in the humanities and social sciences far outnumber those in the natural and applied sciences and that these programs are closely tied to efforts to incorporate underrepresented populations and underrepresented regions of the world into the structure of academic knowledge. In this respect, our findings are consonant with other studies that have called attention to the role of social movements as a source of curricular change in the humanities and social sciences (see, e.g., Moses, 2000; Olzak & Kangas, 2007; Rojas, 2006; Slaughter, 2002). New technology development is undoubtedly the more important influence on graduate-level collaborative research, but social incorporation looms large in the undergraduate curriculum.

Why Do Interdisciplinary Programs Persist?

One remaining question concerns the persistence of interdisciplinary organization in academic institutions whose foundations, particularly in the undergraduate curriculum, are built on departmental majors (Abbott, 2002).

We do not consider interdisciplinary organization likely to continue in all fields. New brain and biomedical science fields, like cognitive science and

neuroscience, should eventually become institutionalized in the departmental structure. Such a trajectory would follow a well-worn path of new academic disciplines, identified by Metzger (1987) as "subject parturition" followed by "subject dignification." It is also possible that environmental studies will eventually become more fully institutionalized in the departmental structure of universities, although this trajectory is less certain because environmental studies retains an activist impulse that rests uneasily in the more professionalized structures of academic departments.

In some cases, departmentalization is a logistical problem. International relations programs, for example, must combine expertise from many disciplines and span all (or at least most) parts of the world. In other cases, programs may attract too few students to warrant institutionalization as departments. Some period history programs, such as medieval studies and renaissance studies, have been unable to attract sufficient numbers of majors to warrant departmental status.

The most interesting cases are those in which some sponsoring faculty members prefer interdisciplinary to departmental organization, because they perceive interdisciplinary organization to be friendlier to activism than the more professionalized structure of departmental organization. Clear evidence of this preference can be found in interview- and document-based research on women's studies (Boxer, 1998; Stimpson & Kressner Cobb, 1986) and race and ethnic studies (Gates, 1992; Rojas, 2007) programs. As noted, environmental studies, too, is a field that has long appealed to the activist sensibilities of students and faculty who are concerned about environmental protection (see, e.g., Altbach, 1997; Klee, 1983). These preferences for flexible forms of organization supporting activist outlooks may coincide with the interests of administrators in representing socially incorporative fields without allocating high levels of permanent resources to them.

These expressed preferences underscore the relationship between social identity, social activism, and interdisciplinary research and teaching in the humanities and social sciences. Many interdisciplinary programs represent a niche space within the large and expanding structure of academic knowledge for students and faculty interested in exploring social identity and promoting social change. More broadly, they offer courses that can help students in other majors to become culturally more knowledgeable and effective actors in the diverse settings of adult life (Gurin, 1999; Hurtado et al., 2003). Nor is the support of academic administrators for interdisciplinary organization in these fields necessarily a surprise. Evidence is accumulating that many academic administrators are interested in the uses of the university as an engine of economic and social change, as well as in the traditional role of the university as a creator and disseminator of specialized knowledge (Brint, 2005; Feller, 2005; Sa, 2006).

During the 25-year period covered by our study, the number of inter-disciplinary fields on campus grew rapidly. In the future, as some current interdisciplinary programs are incorporated into the departmental struc-ture, new interdisciplinary fields will likely arise. Interdisciplinary programs are a relatively inexpensive way to support fields that involve expertise drawn from more than one discipline and to accommodate academic and extra-academic interests in economic and social change. At the same time, they create new lines of connection across campus. In all likelihood, they strengthen networks of professors who are sympathetic to new cross-campus initiatives to promote economic innovation and to solve societal problems. These networks contribute to the changing climate of opinion on college and university campuses about the value of interdisciplinary work. It is even possible that professors in some interdisciplinary fields can have an impact beyond their numbers, because their networks crosscut departmental lines and their outlooks on the university emphasize activism.

CONCLUDING OBSERVATIONS

Interdisciplinary studies are now well established and widely embraced in academic institutions. Future research can help us better understand this growing arena of academic activity. In our view, future work might attend, not only to the sponsors and institutional addresses of interdisci-plinary fields, as we have done, but also to the processes by which students become interdisciplinary thinkers and the difference this makes in ways of interpreting and understanding phenomena. (For an interesting qualitative study of interdisciplinary socialization, see Holley, 2006). Future researchers might also begin to study in a more rigorous way whether interdisciplinary work in fact leads more often to substantive intellectual breakthroughs, as its advocates contend, as well as the intellectual and social conditions under which it can lead to breakthroughs (see, e.g. Hollingsworth & Hol-lingsworth, 2000).

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