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THE GROWTH OF FIVE US DESIGN DISCIPLINES, 1984-2012

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ABSTRACT

This paper undertakes a quantitative, macro-comparative study of the institutionalization and growth of five design disciplines (architecture, landscape architecture, urban/city planning, interior design, industrial design) in the US. By analyzing the intra- and extra-institutional resources and conditions that promote the growth of design disciplines using lagged random effects regression models, the paper provides valuable insights to policymakers and administrators who seek to make meaningful interventions within the academy and will advance sociological understanding of the changing organization of academic knowledge.

This study is unique for a couple of reasons. First, it is the first of its kind that utilizes IPEDS database. Second, there are no analyses that assess the growth and institutionalization of design disciplines using longitudinal data and complex statistical tools. The studies in the extant literature are generally limited to historical and isolated cases studies and as such, far from providing a holistic picture of the development of design in the US Higher Education.

Keywords: Design education in the US, longitudinal analysis, higher education, sociology of design

1 INTRODUCTION AND BACKGROUND

This paper analyses the patterns of growth and decline among design disciplines during the period 1984–2010 in the US higher education system. I examine the institutional trajectories of the five major design fields: architecture, interior design, landscape architecture, urban/city/community and regional planning (henceforth, urban planning), and industrial design. These five fields were selected because: a) they are older and more established design fields compared to others, and hence provide an exemplar for the newer design disciplines; and b) since they are older, the data regarding them is more consistent and goes back to 1984 without any major problems that may jeopardize my research design. In some other fields (e.g. graphic design, jewelry design, fashion design etc.) the coding schemes of my data sources are not as robust.

My research objectives are fourfold. First, I will examine the institutional factors that inhibit or promote the institutional growth of design disciplines. Second, I will also examine the extra-institutional factors that inhibit or promote growth (e.g. unemployment and economic growth). Third, I will analyze how visual arts and engineering fields affect the institutional growth of the design disciplines as these fields share historical/institutional ties. Fourth, I will investigate the effects of the “disciplinary clustering” effect on the growth and institutionalization of the design disciplines.

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I use Abbott's (2001) structural theory of interdependent disciplinary systems as my overarching explanatory framework.

At the locus of Abbott's theory is the idea that disciplines form an interdependent system. The core trait of the system is the importance of the undergraduate education and the disciplinary majors (Abbott, 2001, pp. 126–128). Undergraduate enrolments are crucial "resources" since they are used to determine funding allocations to various units and opening of new faculty positions within universities (ibid.).

Interdependence entails competition but also mutual dependence, support, and renewal: "the strong overlap between disciplines also means that the disciplines can perpetually renew and challenge each other. They are too big to ignore each other completely, yet too small to overwhelm each other" (Abbott, 2002, p. 217).

Like competition, mutual dependence also operates on epistemological and organizational/institutional levels. On the organizational level, fields compete for students and other resources; but they also form organizational clusters that increase their institutional power. A typical organizational cluster in the US academe is "school." For example, design disciplines tend to be organized under schools of design or architecture. This arrangement allows fields to exercise greater influence on the decision-making processes of higher education institutions, thereby increasing their institutional power. Naturally, "allied" fields, or fields that share common historical roots, tend to flock together. To offer an obvious example, social sciences (i.e. sociology, economy, political science, etc.) establish "bundles" of social sciences, health sciences have their own organizational groups, and so on.

It is important to note that most scholars tend to focus on competition and ignore mutual dependence and support mechanisms; hence Abbott fills an important gap.

2 DATA AND METHODS

This study employs a unique dataset that we constructed by merging files from the IPEDS (Integrated Post-Secondary Education Data System. 1984-2010) surveys and various other sources. The surveys contain information on more than 1,100 distinct academic fields of study at more than 6,700 degree- and non-degree-granting institutions of higher education in the US (http://nces.ed.gov/ipeds/about/). Their combination of field-, institution- and organization-level data make IPEDS particularly well-suited for a national study of disciplinary change.

My population of interest is four-year colleges and universities in the US. To minimize problems with missing data, I excluded from analysis institutions with the following characteristics: four-year institutions with fewer than 200 students, non-Carnegie institutions, religious seminaries, American Indian tribal colleges, as well as institutions located in non-state US territories (e.g. Guam, Puerto Rico). To maximize statistical power, I collected data from the remaining institutions every other year between 1984 and 2008 inclusive. Sample size across these years varies from 1,484 institutions in 1984 to 1690 institutions in 2010.

I have two dependent variables: *institutional presence* and *share of bachelor's degrees*. Presence is a dichotomous measure of the existence of a discipline in a

given institution in a given year. In IPEDS fields are represented by the conferral of Baccalaureate, Master's or Ph.D. degrees. The variable was coded 1 if one or more degree (of any type) was conferred in a given year; 0 if no degrees were conferred. Share, on the other hand, is operationalized as the percentage of bachelor's degrees offered in one of the five core design disciplines at a given institution in a given year relative to all the bachelor's degrees granted in the same institution for the same year. It is multiplied by 100 and logged to normalize distribution, and is coded separately for each of the five fields to be used in separate models.

Independent variables used in this analysis are measures of exogenous or contextual factors as well as endogenous or institutional-level factors theorized to influence population change in academic fields (see Table 1). In the models used in this study, I lag independent variables four years, the standard time frame for completing an undergraduate bachelor's degree, to account for the delayed effects of institutional and organizational inertia. Contextual variables were taken from the U.S. Census and U.S. Bureau of Labor Statistics and include the total population (logged) of the state in which the institution is located, as well as that state's gross domestic product (logged), annual unemployment rate. Institutional-level variables are specific to the university or college housing the departments of interest. For a full list of the institutional level variables, see Table 1 below.

Table 1 Pooled Descriptive Statistics, 1984-2010

	MINIMUM	MAXIMUM	MEAN	ST. DEV.
Dependent Variables				
Institutional Presence				
Architecture	0	1	0.07	0.25
Landscape Architecture	0	1	0.03	0.18
Urban/City/Regional Planning	0	1	0.06	0.23
Industrial Design	0	1	0.02	0.15
Interior Design	0	1	0.08	0.28
Institutional Share (Ln)				
Architecture	1.31	9.21	5.47	1.08
Landscape Architecture	0.63	7.59	3.91	0.89
Urban/City/Regional Planning	0.49	6.33	3.72	0.9
Industrial Design	0.34	9.21	5.05	1.68
Interior Design	0.42	9.21	5.01	1.46

Key Independent Variables				
Institutional Presence				
Visual Arts	0	1	0.63	0.48
Engineering	0	1	0.25	0.44
Institutional Presence				
Other Design for Architecture	0	1	0.24	0.43
Other Design for Landscape Arc.	0	1	0.25	0.43
Other Design for Urban Planning	0	1	0.24	0.42
Other Design for Industrial Design	0	1	0.25	0.43
Other Design for Interior Design	0	1	0.23	0.42
Architecture	0	1	0.07	0.25
Institution Size (Ln)*	0	5.61	3.20	1.11
Institutional Share of Bachelor's Degrees (Ln)	0	0.58	0.06	0.08
Controls				
State Population (Ln)	13.02	17.43	15.75	0.93
State Unemployment	2.3	14.9	5.87	1.89
State GDP (Ln)	10.06	11.48	10.62	0.18
Doctoral Institution	0	1	0.41	0.49
Private Institution	0	1	0.68	0.47
Total Revenue per Student (Ln)	2.31	14.15	9.83	0.72
Percent Women (Ln)	0	4.6	3.97	0.44
Percent Minorities (Ln)	0	4.61	2.67	0.9
Institution's Age	0	374	97.35	47.24

For this study, the preferred method for the statistical analyses is *lagged random effects time series regression* models. The dataset that I use in my analyses is characterized by unbalanced panel structures, and for each of the units I have a vector of different variables whose values are recorded over a period of time. Although panel data have important advantages, they also have important peculiarities. Since repeated observations of the same unit are generally positively correlated, conventional regression methods that assume independence between individual observations are not appropriate to analyze such data. Although conventional regression models may produce unbiased coefficients when used with longitudinal data, they may lead to standard errors, and p-values are also much lower than they should be.

Two of the most common methods that are employed by social scientists to deal with the peculiarities of such longitudinal data are fixed-effects regression models and random-effects regression models. Such models have several advantages over conventional regression models.

It is reasonable to use fixed-effects models when there is evidence of significant within-unit variation across time and when the number of units in the analysis is not very large (Castilla, 2007; Wooldridge, 2002). My sample does not fit these criteria. My sample size is quite large, varying between 1400 to 1600 institutions observed across 14 time points between 1984 and 2010. Furthermore, because of institutional inertia, within-unit variation is very small. In such cases, random-effects models provide more reliable estimates (Castilla, 2007).

A random-effects model takes the following general form for continuous dependent variables:

$$y_{it} = \mu_\tau + \beta x_{it} + \gamma z_i + \alpha_i + \varepsilon_{it}$$

Here y_{it} is the value of the dependent variable for unit *i* at time point *t.* While z_i is a vector of variables that describe units but do not vary over time points, x_{it} is a vector of variables that vary over both units and time points. Both β and γ are row vectors of coefficients. α_i "represents all the differences between individuals that are stable over time and not otherwise accounted for by γz_i. It can be said to represent unobserved heterogeneity" (Allison 2011, 11).

3 DESCRIPTIVE ANALYSIS: FIELD SIZE AND SHARE OF BACHELOR'S DEGREES

The size of academic fields grows larger or smaller as the number of academic departments and programs granting degrees in those fields increase or decrease. I operationalize field size as the percent of institutions that offer a bachelor's degree in a given field in a given year. This relative measure is more robust compared to reporting the absolute number of institutions that offer degrees in a given design field, as reporting percentages takes the growth of the higher education system into consideration. (i.e. more new institutions are founded each year compared with the number of ones that become defunct). Figure 1 reports the percentages of institutions with a certain design discipline.

In 1984, 6.13% of the four-year colleges and universities in the sample had interior design departments/programs, whereas in 2010, 9.94% of the higher education institutions housed interior design. Compared with interior design, the increase in architecture is more modest, from 6.4% in 1984 to 7.44% in 2010.

In landscape architecture, on the other hand, the change in percentage is even smaller, from 3.23% to 3.69%. The only field that witnessed decline is urban planning. The percentage of higher education instituions that accommodated urban planning units decreased from 6% to 5.48%.

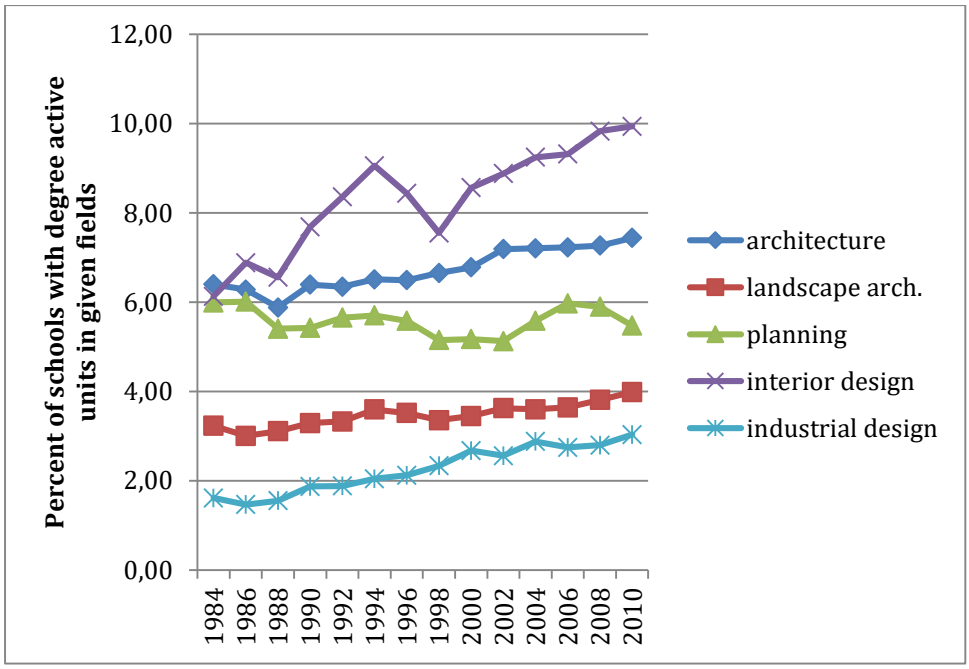

Figure 1: Relative Field Size: Percentage of Institutions with Degree-Active Units in Five Design Fields, 1984–2010

Design disciplines are growing and have become an important part of US higher education. The younger fields (industrial design and interior design) are growing faster than the older ones. The exception to the general growth trend is urban planning. In terms of absolute size (data not shown) urban planning is almost stable, and in terms of relative size, there is a modest decline. This is probably due to the rising importance of urban planning as a field of graduate study in recent years. That is, architects and landscape architects began see urban planning as a good choice for graduate education. Following this trend, more graduate-only planning departments began to be founded (Alofsin, 2002).

Younger fields drive the change. As a field grows older and bigger, even from a purely probabilistic viewpoint, there will be less room for growth. The mutual exchange between the younger and the older fields challenges and thus renews academic domains and prevents them from becoming irrelevant or obsolete.

It is also important to consider a field's share of bachelor's degrees, a measure of proportionate growth that provides additional information about the ability of fields to attract and graduate undergraduate majors relative to other fields competing for similar institutional resources. Because the number of degrees that academic units confer annually factor into administrative decisions governing resource allocation at universities and colleges (Weerts and Ronca, 2006), fields that produce proportionately fewer degrees are comparatively less stable than fields that produce more degrees. By aggregating the annual percentage of degrees and dividing by the total number of institutions conferring degrees in each year, we gain a longitudinal view of a field's proportionate growth.

Figure 2 reports the share of bachelor's degrees conferred in five design disciplines. Architecture and landscape architecture, which exhibited absolute growth in the number of conferred bachelor's degrees (data not shown), lost some of their share during the same time period. Whereas architecture's share dropped from 0.47% to 0.39%, landscape architecture's decreased by 0.03 percentage points between 1984 and 2010.

The remaining three disciplines both enjoyed absolute and relative growth. Planning's share increased from 0.04% to 0.05%, interior design's from 0.14% to 0.26%, and industrial design's from 0.04% to %0.09. Although industrial design and urban design had almost the same share of undergraduate degrees in 1984, industrial design surpassed that of urban planning by 0.04% percentage points in 2010. Although these changes may seem small, they should be interpreted in light of a growing system. Continuous inclusion of new disciplines and interdisciplines is an inherent feature of the system of higher education, and although one discipline's vitality may erode in time, disciplines seldom disappear completely (Abbott 2001). The findings suggest that a strong presence over time may not translate into a growing share of student enrollment. Hence, it is important to separately analyze these distinct processes when assessing the growth of disciplines.

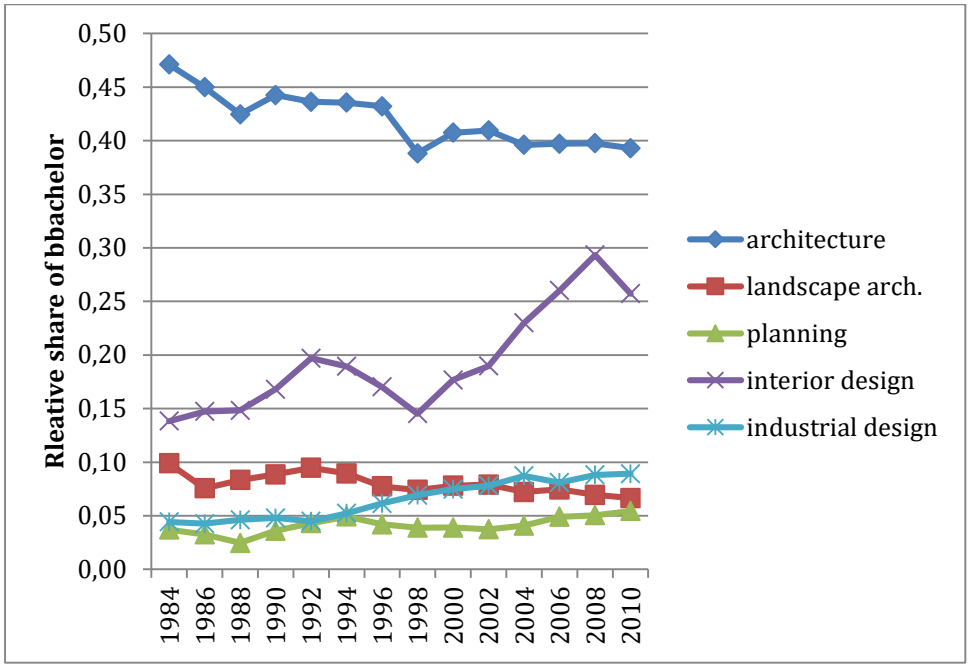

Figure 2: Share of Bachelor's Degrees Granted in Five Design Disciplines, 1984–2010

4 MULTIVARIATE ANALYSES: FACTORS AFFECTING INSTITUTIONAL PRESENCE AND SHARE OF UNDERGRADUATE DEGREES IN FIVE DESIGN DISCIPLINES

In this section, I employ multivariate statistical techniques to investigate the causal relationships that play a role in the growth of five core design fields. I have two dependent variables: *presence* and *share of bachelor's degrees*.

For the analysis of institutional presence and share, I added institutional presence of (other) design fields as the key independent variable. For each of the five design disciplines, I coded whether an institution housed at least one

degree-active design discipline other than the discipline of interest. For example, in the model using the presence of architecture as the dependent variable, I coded whether an institution housed at least one degree-active design unit, aside from architecture. By adding this variable I can test Abbott's (2001) and Jacobs's (2013) theories regarding the mutual dependence between fields, especially between ones with close historical and/or organizational ties. I expect that the previous presence of other design disciplines, especially architecture, will have a positive effect on the presence of other design fields.

For the analyses of the share of undergraduate degrees, I used presence of other design, visual arts, and engineering fields as my key independent variables, instead of share of bachelor's degrees granted in other design, visual arts, and engineering fields. Using presence instead of share as key independent variables does not drastically alter the behavior of other independent measures in the model. Furthermore, presence measures are found to be more consistent predictors of institutional share of bachelor's degrees. For some models, I have also added the presence of architecture as a key independent variable. For the historical reasons that are well known, architecture is an especially important design discipline. It is the first one that was institutionalized professionally and academically and thus, is institutionally more "powerful" compared to other design fields (Blossom 2013, personal communication). Institutional power, in this context, is the ability to impact intra-institutional decision-making processes and resource allocations.

This section complements the field-level descriptive analyses presented in the previous section by shedding light on the causal mechanisms that influence the institutional growth of five core design disciplines.

4.1 INSTITUTIONAL PRESENCE

As Table 2 shows there are two variables that consistently cut across levels and disciplines as a statistically significant predictor, institution's share of undergraduate degrees and presence of other design fields.

Table 2: Lagged Random Effects Logistic Regression Models Predicting Institutional Presence of Five Design Disciplines in Four-Year Universities and Colleges, 1984–2010

	ARCHITECTURE	LANDSCAPE ARCHITECTURE	URBAN PLANNING	INDUSTRIAL DESIGN	INTERIOR DESIGN
Presence of Other Design Fields	2.947*** (0.509)	7.898*** (1.548)	1.004* (0.417)	3.624*** (0.491)	1.308*** (0.206)
Presence of Visual Arts	1.554* (0.681)	-1.111 (1.565)	-1.202* (0.599)	2.564*** (0.675)	-0.421 (0.247)
Presence of Engineering	2.632*** (0.608)	4.116* (1.942)	0.755 (0.458)	-0.656 (0.517)	0.807** (0.275)
Institution Size	-0.00617 (0.318)	4.288*** (1.066)	1.117** (0.404)	-0.592* (0.301)	0.0992 (0.171)

Institutional Share of Bachelor's	35.36***	46.97***	19.96***	18.00***	19.36***
	(5.938)	(7.638)	(2.953)	(3.389)	(2.536)
State Population	-0.896*	-1.426	0.0592	0.330	-0.137
	(0.419)	(0.740)	(0.385)	(0.339)	(0.194)
State Unemployment	-0.0738	-0.248	0.230*	0.140	0.227***
	(0.140)	(0.269)	(0.101)	(0.129)	(0.0663)
State GDP per Capita	1.730	-5.078	3.161*	2.651	1.820
	(2.208)	(3.759)	(1.488)	(1.798)	(1.007)
Doctoral Institution	3.582***	4.342	6.635***	-0.916	0.0738
	(0.802)	(2.806)	(0.891)	(0.667)	(0.351)
Private Institution	0.903	-7.225***	-8.985***	0.335	0.908*
	(0.866)	(1.587)	(0.878)	(0.672)	(0.406)
Revenue per Student	0.237	4.830***	0.649*	0.0124	-0.129
	(0.183)	(0.698)	(0.323)	(0.353)	(0.155)
Percent Women	-2.822***	-4.952	1.019	-1.303**	2.628***
	(0.545)	(3.036)	(1.261)	(0.410)	(0.589)
Percent Minorities	2.170***	0.828	0.256	-0.174	-0.265
	(0.436)	(0.823)	(0.375)	(0.323)	(0.171)
Age of Institution	0.0255**	0.0141	0.0401***	-0.00710	-0.001
	(0.00902)	(0.0113)	(0.00657)	(0.00587)	(0.004)
Constant	-30.66	-11.31	-73.21***	-44.77*	-41.27**
	(22.14)	(40.59)	(16.32)	(18.27)	(10.42)
Pseudo R^2	0.19	0.44	0.16	0.20	0.06
AIC	1428.4	636.6	1642.7	1148.4	3551.2
BIC	1639.8	848.0	1854.1	1359.8	3762.6

Standard errors in parentheses; bi-annual year dummies not shown
** $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-tailed tests*

As an institution's share of undergraduate degrees increase, this translates into increased odds of presence for design disciplines. This finding underscores the importance of the idea of "major" and undergraduate education, as Abbott (2001) asserts. As disciplines compete within an education institution for student enrollments, so do the institutions that form the higher education system (ibid.). This finding demonstrates that institutions that have the upper hand in the

competition for students provide more favorable environments for the continued presence of disciplines. I think this finding is not specific to design disciplines but indicates a systemic mechanism.

Presence of other design fields, is the only other independent measure that is consistently significant across five core design disciplines. It seems that once design establishes a presence in the campus, it becomes easier for other design programs to become a part of the curricula, net of other factors such as the size of the institution. This threshold effect is, I think, due in part to the institutional inertia and disciplinary clustering. This is a good example of the mutual support/renew side of Abbott's (2001) interdependent disciplinary processes. Although this is a systemic process, it may have different manifestations for different disciplinary clusters. For historical reasons cited in chapter 2, design disciplines tend to cluster in "schools of architecture" or "schools of design." Architecture was the first design discipline to be institutionalized, and most of the first generation of landscape architects and urban planners were architects. For this reason, the newcomers attached themselves to architecture and found themselves organizational spaces under the schools of architecture. Another form of disciplinary clustering is the art school itself. Industrial design education, for example, did not start in schools of architecture but in art schools. More to the point, disciplinary clustering matters as a system-wide phenomenon, but its exact shape is determined by the historical context and origin stories of fields.

Apart from Jacobs's (2013) study of American studies, this mutual support process is largely missing from the literature. Disciplines are generally depicted as being involved in a constant fight to acquire resources (for example see Brint et al., 2009; Rojas, 2007; Turk-Bicakci, 2007). Largely influenced by organizational ecology (Carroll, 1988; Hannan and Freeman, 1989), these scholars see higher education institutions as an arena for endless power struggles. Competition, indeed, is an important part of the system of disciplines. It is especially acute in the cases of the interdisciplinary, socially inclusive fields such as African American studies (Rojas 2007) and women's and ethnic studies (Turk-Bicakci 2007), for these fields were born out of an intense critique of the then-prevailing mechanisms, during the tumultuous years of the 1960s and '70s. Even for these fields, however, competition was not the sole mechanism that initiated growth. More often than not, they needed alliances (Jacobs 2013) or the aegis of more established disciplines (Abbott 2001).

Other than these two variables, every discipline seems to be affected by a unique set of factors. Two distinct forces shape design disciplines' growth: systemic factors that apply to all disciplines, and idiosyncratic factors that may affect two or three disciplines in the same direction, but not all. Systemic factors are typically driven by system-wide expansionary tendencies and the inclusion of more students in the system. Idiosyncratic ones are inherently more complex and are mostly tied to the unique histories of each field.

As these idiosyncrasies show, it is important not to overstate Abbott's (2001) claims. Along with my findings, there is ample evidence (for example see, Frickel and Ilhan 2013; Jacobs 2013) that disciplines and interdisciplines indeed form an interdependent system. However, fields do not grow in uniform ways. More research is necessary to assess the reasons behind these differences.

4.2 SHARE OF BACHELOR'S DEGREES

Academic disciplines and interdisciplines constitute a dynamic, relational field (Abbott, 2005, 2001); an analysis of presence provides only a partial picture of growth and institutionalization. Hence, I also provide an analysis of share of bachelor's degrees for five core design fields. Share is an especially good measure to assess competition between neighbor fields. Student enrollment is an important source that disciplines compete for, as it impacts internal funding decisions and other resource allocations such as new faculty positions (Abbott 2001). Fields with a decreasing share may become less competitive and anemic.

The descriptive analysis in section 3 (see figures 1 and 2) has shown that although all five core design fields have increased the absolute number of bachelor's degrees granted between 1984 and 2010, the two oldest design disciplines, architecture and landscape architecture, did not enjoy a growth in the share of bachelor's degrees. This section complements the descriptive findings by offering a causal analysis of the factors affecting the share of bachelor's degrees, at the institutional level.

For each of the following analyses, I used a limited sample, including only institutions with degree-active units in the given discipline. For the following model that predict architecture's institutional share of bachelor's degrees, for instance, only institutions with degree-active architecture units are utilized. R^2 statistics are reported for assessing the model fit.

Furthermore, I used presence of other design visual arts and of engineering fields as my key independent variables, instead of share of bachelor's degrees granted in other design, visual arts, and engineering fields. Using presence instead of share variables as key independent variables does not drastically alter the behavior of other independent measures in the model. Presence measures are found to be more consistent predictors of institutional share of bachelor's degrees.

Table 3: Lagged Random Effects GLS Regression Models Predicting Institutional Share of Bachelor's Degrees Granted in Five Design Disciplines in Four-Year Universities and Colleges, 1984–2010

	ARCHITECTURE	LANDSCAPE ARCHITECTURE	URBAN PLANNING	INDUSTRIAL DESIGN	INTERIOR DESIGN
Presence of Architecture		-0.425***	0.635*	0.345*	-0.0129
		(0.106)	(0.247)	(0.170)	(0.105)
Presence of Other Design Fields	0.140*				
	(0.0604)				
Presence of Visual Arts	-0.0260	0.0559	0.0437	0.0133	-0.141
	(0.181)	(0.202)	(0.100)	(0.210)	(0.0806)
Presence of Engineering	0.116	-0.235	-0.0912	0.0867	-0.172*
	(0.136)	(0.133)	(0.125)	(0.214)	(0.0760)
Institution Size	-0.314*	-0.197	-0.830***	-0.956***	-0.461***

	(0.128)	(0.209)	(0.246)	(0.167)	(0.0800)
Institutional Share of Bachelor's	-1.559* (0.647)	-2.659*** (0.605)	-0.0875 (1.148)	-2.196 (1.368)	-0.777 (0.603)
State Population	0.116 (0.0763)	0.254** (0.0978)	0.00765 (0.143)	0.0351 (0.126)	0.0803 (0.0745)
State Unemployment	-0.00640 (0.0202)	0.0114 (0.0281)	0.0227 (0.0429)	-0.0393 (0.0461)	0.0803 (0.0745)
State GDP per Capita	0.209 (0.422)	0.201 (0.439)	-0.104 (0.867)	-0.142 (0.777)	-0.157 (0.365)
Doctoral Institution	-0.740** (0.237)	0.859** (0.314)	-0.366 (0.330)	0.0503 (0.302)	-0.351* (0.156)
Private Institution	0.135 (0.183)	-0.357 (0.388)	0.0774 (0.359)	0.364 (0.289)	0.403** (0.145)
Revenue per Student	0.0737 (0.104)	-0.0287 (0.196)	0.0114 (0.0135)	0.156 (0.162)	-0.0031 (0.042)
Percent Women	-0.488* (0.237)	-0.498 (0.530)	0.459 (0.941)	-0.126 (0.191)	0.719*** (0.186)
Percent Minorities	-0.0864 (0.0770)	-0.523*** (0.123)	0.0732 (0.146)	-0.0145 (0.162)	-0.110 (0.0564)
Age of Institution	-0.00341* (0.00158)	0.001 (0.003)	-0.003 (0.003)	0.001 (0.003)	-0.01*** (0.003)
Constant	5.116 (4.075)	4.110 (5.921)	5.814 (10.55)	8.838 (7.534)	5.435 (3.760)
R2 (overall)	0.63	0.54	0.26	0.84	0.72
N	1087	509	327	366	1357

Standard errors in parentheses; bi-annual year dummies not shown
$^{*}p< 0.05$, $^{**}p< 0.01$, $^{***}p< 0.001$, two-tailed tests

Table 3 shows the results of the regression analyses that predict the share of bachelor's degrees for the five design disciplines. For the five core design disciplines, previous presence of other design disciplines (for architecture and interior design) or presence of architecture (for landscape architecture, urban planning, and industrial design) are the important independent variables that are positive and statistically significant. Disciplinary clustering and mutual support processes are important (Abbott 2001, Jacobs, 2013). Although we do not know exactly how this mutual reinforcement process works, these findings still support Abbott's interactive system model and warrant further research that will enhance his theory.

Apart from this, there is very little consistency across the five core design disciplines. This shows that, although Abbott's theory is important and explains much, it is not a catch-all framework that draws a complete picture. For example, institution size is an important predictor, yet it does not appear to be significant for landscape architecture and interior design, giving partial support to organizational theories emphasizing the carrying capacities of institutions (e.g. Blau, 1994). Likewise, being a doctoral institution is also important, yet this predictor is not significant in the models of urban planning and industrial design.

There is also mixed support for sociodemographic theories that assert the importance of women and previously underrepresented minorities. Although the increasing campus presence of women negatively affects one of the five disciplines (architecture), it has a positive influence on the share of bachelor's degrees for interior design. In contrast to researchers' prediction that minorities will choose job-relevant curricula (Trow and Carnegie Commission on Higher Education., 1973) , one design disciplines share is influenced negatively by the increasing enrollment of minorities (landscape architecture). One possible explanation is the effect of the location of the higher education institutions and how that location affects minority enrollment and the minority enrollment impact on disciplines. It might be the case that certain disciplines cluster in certain areas (e.g. the South) or in more urban areas with more diverse populations; hence these nonincluded variables may be impacting the results. More research conducted using new variables is needed in the future to test these ideas.

Finally, in terms of share, there is very little support for theories (e.g. (Geiger, 2004; Slaughter and Leslie, 1997) claiming that external factors will have considerable impact on the growth of applied fields. The system-wide expansion, and competition and support between disciplines seem to be more important than external economic processes.

These findings, once again, show that there are different facets and levels of growth and that each one deserves distinct attention.

5 CONCLUSION

Apart from a handful of studies that utilize longitudinal data (Brint et al. 2009; Brint et al. 2012; Frickel and Ilhan 2013; Rojas 2007; Turk-Bicakci 2007), we still largely are in dark about how large-scale disciplinary change occurs.

This paper aimed to fill a portion of this gap by developing a longitudinal analysis of the intra and extra-institutional factors that influenced the growth and institutionalization of design disciplines between 1984 and 2010. Using IPEDS in a novel way to include extra-institutional state-level variables, I showed how design disciplines grew in the last twenty-six years and how

different intra- and extra-institutional factors shaped this growth. This dramatic growth during the last twenty-five years in the US is quite remarkable. Design disciplines are at the forefront of what Brint (2002) calls "the rise of the practical arts", on par with business, neuroscience, and various health fields.

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