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ABSTRACT

This paper hypothesizes (1) the softer the subject, or (2) the purer the subject, or (3) the more a subject can be characterized as life-oriented, the greater the number of books that will be charged. Interaction and higher order (polynomial) combinations between the three characteristics are also hypothesized. A scale value for each characteristic of 60 academic subjects is determined by a survey of faculty at the University of Southwestern Louisiana. Correlation and multiple regression are employed to assess the proportion of variance accounted for. Hypothesis (1) is weakly supported; hypothesis (2) is modestly supported providing other variables are not held constant. Hypothesis (3) is not supported under any conditions tested nor are any of the hypothesized interactions or higher orders. (Author/WBC)

Relationships Between Hard/Soft, Pure/Applied, and Life/Nonlife Disciplines and Subject Book Use in a University Library

by

William E. McGrath

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ABSTRACT

In a university library, variability in circulation of books by subject area is partly but directly dependent on the academic program--e.g., if the anthropology department enrolls more students than the physics department, then more anthropology books should circulate. However, if the number of students enrolled in each subject is the same, the number of books circulated in one subject may still be larger than in the other. Therefore, other sources accounting for variability must be sought. One possible source is in the nature of the subjects themselves. For example, subjects (as represented by academic disciplines or departments) are often called hard or soft, pure or applied or life or nonlife. The purpose of this paper was to determine the relationship between these characteristics and the number of books charged out of an academic library by students. Three major hypotheses were formulated:

(1) the softer a subject, the greater the books charged on that subject; the harder the subject, the fewer the books charged;

(2) the purer the subject, the greater the books charged; the more applied the subject, the fewer the books charged;

(3) the more a subject can be characterized as life oriented, the greater the difference in number of books charged between that subject and those characterized as nonlife oriented.

Interaction and higher order (polynomial) combinations between the three characteristics and book charges were also hypothesized. A scale value for each characteristic in each of 60 academic subjects was determined by a survey

of faculty of the University of Southwestern Louisiana. Correlation and multiple regression were employed to assess the proportion of variance accounted for by each of the three characteristics. Other variables--masters, upper and lower level enrollments, credit hours being taught, number of books already in the library, and level of degree offered--were entered into the regression equation as controls. Hypothesis (1) was weakly supported under the condition that shelflist and masters enrollments were held constant. Hard/soft was also significant when pure/applied was held constant, but shelflist and enrollments were not. Hypothesis (2) was modestly supported under the condition that other variables were not held constant. Otherwise pure/applied was not significant. Together pure/applied and hard/soft, in that order, and when no other variables were controlled accounted for 26% of the variance. Hypothesis (3) was not supported under any of the conditions tested, nor were any of the hypothesized interactions or higher orders. Results have implications in sociological understanding of the relationship between disciplines and library use, in formulating a rationale for library collection building, and in administrative, budget allocations to subjects.

RELATIONSHIPS BETWEEN HARD/SOFT, PURE/APPLIED, AND LIFE/NONLIFE DISCIPLINES AND SUBJECT BOOK USE IN A UNIVERSITY LIBRARY[1]

William E. McGrath

Introduction

Leroy Merrit [1] complained that, with certain exceptions,

> no authority in the library field has addressed himself to an a priori philosophical consideration of how a library ought to be evaluated, what the criteria ought to be, or where the boundary lies between excellence or mediocrity. [1, p. 55-56]

It is with Merritt's complaint in mind that the general problem of this paper is stated: on what theoretical or empirical grounds can a sound collection building philosophy for an academic library be constructed?

Neither of two philosophic goals perhaps most widely defended in principle, that of self-sufficiency [2] and the "slice-of-everything" approach [3] have been attainable in practice. Comprehensive, economic schemes for acquiring the world's information have yet to satisfy fully the specific or even general needs of library users. Farmington plans, standing orders, blanket orders, approval plans, and the like have filled our libraries to the bursting point, yet all too frequently, our collections cannot supply the right book at the right time.

Having failed to build unlimited collections, many librarians have come to realize that only a well-founded theoretical/empirical basis for delimiting acquisitions can begin to solve the problem. This paper does not offer a new collection building philosophy nor "acquisitions plan" as such. Nor is a coherent theory developed. It does attempt to lay some groundwork

1. This paper is based on portions of the author's doctoral dissertation, which was submitted to the School of Information Studies, Syracuse University, August, 1975.

for the development of theory by seeking empirical evidence that use of library is related to characteristic differences of academic disciplines. Hence, it seeks a rationale, but not a mechanism for gearing collection building to the university program through those disciplines.

Books and journals are acquired to be used, and therefore amount of use is one criterion for evaluating a library collection. If so, then the challenge for collection builders, since purchasing funds are necessarily restricted, is to predict or otherwise understand use. Predicting amount of use of newly published, specific titles has proven to be a difficult and perhaps misdirected task for libraries. Specific titles may be less important to the reader than the general subject in which the title falls. Users are often satisfied to find any book on a subject. It seems reasonable to assume, therefore, that library users may be more concerned with subject content and its availability in their libraries. In other words, a library may be evaluated on whether it has any book on a given subject. If so, prediction of subject use should be worthwhile. However, ability to predict, though all important, is still not sufficient. Understanding is needed. In the same sense that it is not difficult to predict sunrise from knowledge of past sunrises, it is not difficult to predict one year's use from a knowledge of the previous years' use. A more fundamental approach would be to explain why some subjects are used more than others. Hence, prediction may follow from explanation in a theoretical sense but not necessarily vice versa. A better understanding of the variables that contribute to the differences in subject use would help librarians to build collections which match the interests of the library's users, and thus would provide one base for a priori evaluation. Thus, this paper deals only with explanation. A subsequent paper will deal more directly with prediction.

Theoretical Context--Sociology of Disciplines

A basic assumption in this paper is that library usage is directly, but not completely dependent on the academic program. For example, if anthropology enrolls more students than physics, then more anthropology than physics books should be used. However if the number enrolled in each department is the same, book use may still be larger in one than the other. Therefore, additional sources of variability in use must be sought. One possible source is in the nature of the subjects or disciplines themselves.

Inherent characteristics of subject matter, embodied in the disciplines, should vary greatly and thus should be significant contributors to variability in subject book use. Use of journals is not considered in this paper, although it is recognized that for a full understanding of the questions involved, journal usage should be studied.

The theoretical context of this study may thus be placed in the sociology of disciplines, or the sociology of science, i.e., the study of behaviorial differences in disciplines. There are, apparently, few studies relating characteristic differences to library usage.

According to Crane [4],

> The effectiveness of much of the research on scientific communication is inhibited by our lack of precise knowledge of (1) the intellectual differences between scientific fields and (2) the intellectual and social relationships between these fields. [4, p. 16]

Biglan [5] empirically identified three sociological characteristics of subject matter which he then correlated with scholarly output of academic departments [6]. The three characteristics were:

(1) the hard/soft distinction, which Biglan equated with Thomas Kuhn's [7] concept of paradigm development of disciplines;

(2) the pure/applied distinction;

(3) the life/nonlife distinction; i.e., that between concern with life systems and concern with nonlife systems.

The three characteristics were derived from a multi-dimensional scaling analysis of faculty judgments of similarities between academic departments at the University of Illinois and an unidentified small college. Undoubtedly, academic subjects have more than three characteristics, and Biglan's data could support more than the three they did. However, these three characteristics emerged cleanly and were well supported.

Biglan's is the only work identified in the literature which systematically dealt with more than two characteristics and their relationship to sociological variables, although Storer [8] tentatively hypothesized relationships between two, hard/soft and pure/applied, and several demographic variables.

More than 20 years ago, Stevens [9] found that journal title dispersion, and subject dispersion, "the degree to which the literature of a subject includes publications from different subjects," were

(1) greater for literatures of technologies than for those of pure science;

(2) greater for literatures of new sciences than for those of older sciences;

(3) greater for literatures of social sciences and humantities than for those of natural sciences and technologies.

But it was not clear how Stevens defined and differentiated the subject areas or disciplines.

Storer [10] saw the hard/soft dimension as cultural, and the pure/applied as social. This is derived from the "Mertonian paradigm" in which disciplines are seen both as bodies of knowledge and as organizations of individuals. The Mertonian paradigm, as elucidated by Storer in a collection of Merton's papers [11], has two major components. The first consists of four principal norms, or institutional imperatives which guide scientists. They are universalisms of scientific laws, communism (common ownership of knowledge), disinterestedness, and organized skepticism. Merton called these norms the ethos of science. The second component is the driving energy--the quest for professional recognition, e.g., through priority of discovery or publication, which keeps the scientific institution running. This is the general context in which Storer places the hard/soft and pure/applied variables.

> Just as the distinction between hard and soft sciences has been proposed as the most powerful single variable in explaining disciplinary differences in the cultural realm, it is probably the distinction between basic and applied research that has the greatest explanatory power in the social structural realm. [10, p. 239]

> Whether a discipline's body of knowledge is "hard" or "soft" seems to have important implications for the relations among its practitioners, particularly in terms of communications practices. Whether its members are concerned principally with basic or applied research has consequences for their salaries, the conditions under which they work, and presumably also for the extent of their involvement in the central activities of the scientific community. [10, p. 257]

This implies that the context of subject book circulation may be expressed in cultural terms on the one hand and social terms on the other. That is, subject book use may have meaning in terms of goals and values of society, and in terms of relationships between individuals. For example, use of books in the soft disciplines may be a reflection of the values specific to those disciplines--i.e., to what extent Merton's four norms or other norms are part of a particular discipline. Use of books in the pure disciplines

may first reflect the number of persons reading them. Secondly, it may reflect the manner in which recognition is sought. Workers in pure disciplines may seek recognition through the printed word (by publishing) and will align themselves with disciplines in which the printed word is important. Workers in applied disciplines may gain recognition through invention or applications of material products and thus may produce and therefore read fewer books.

Hard/Soft

The hard/soft concept, though somewhat ill-defined, probably has the strongest support in Thomas Kuhn's theory of paradigm development. According to Kuhn, a paradigm

> . . .stands for the entire constellation of beliefs, values, techniques, and so on shared by the members of a given (scientific) community. [7, p. 175]
>
> A paradigm is what the members of a scientific community share, and conversely, a scientific community consists of men who share a paradigm. [7, p. 176]

Every discipline has its paradigm and may be characterized as being well-developed, or in a state of pre-development. The social sciences or humanities may be pre-paradigmatic, whereas physics and engineering have well-developed paradigms. According to Biglan, a high paradigm or well-developed discipline would be "hard" and a low paradigm discipline would be soft. According to Kuhn, the primary means of scholarly or scientific communication between members in a high paradigm discipline is through journals, and that in a low paradigm discipline through books. This distinction, if it can be measured, should help to account for differences between disciplines in book and journal use in libraries.

Storer [12] regarded hardness and softness as a continuum. He saw hardness as implying tough, brittle, strong unyeilding, impersonal, difficult and aggressive, and softness as implying gentleness, adapting weakness, malleability, sympathy, warmth, informality, and easy. He attempted to measure the differences in nine disciplines by (1) the percent of articles in journals which used author's initials (instead of full names) in references and footnotes--a measure of impersonal and social relations, and (2) the percent of articles using equations and tables (a measure of rigor).

Price [13] used the number of references in individual journals dated within the last five years as a measure of hardness and softness.

Lodahl and Gordon [14] determined the degree of paradigm development in seven disciplines by measuring the amount of consensus, among members of the disciplines, on law, theory and methodology within a discipline. They found that members of high paradigm disciplines (physics, chemistry), agreed more on requirements for degrees and course content for their disciplines than did those of low paradigm disciplines.

Pure/Applied

Feibleman [15] defined pure science as

> . . .a method of investigating nature by the experimental method in an attempt to satisfy the need to know,

and applied science as

> . . .the use of pure science for some practical human purpose. [15, p. 33]

Pure science implies knowing and applied science implies action.

> . . .pure science has as its aim the understanding of nature; it seeks application. Applied science has as its aim the control of nature; it has the task of employing the findings of pure science to get practical things done. [15, p. 33]

He concluded that the "line between pure and applied science is a thin one", and that "the conception of science as exclusively pure or utterly applied is erroneous . . ." He noted that theories discerned in the physics laboratory take some time before becoming standard engineering practice. This has implications for book and journal usage, in that theory is first published in journal articles, later finding its way into text books.

He noted that a discipline can exist somewhere in between, and can be to some degree both pure and applied. One discipline may be more pure or more applied than another.

Amick [16] found that an individual chemist's orientation exists along a basic/applied continuum within the discipline, noting that to classify an individual as either basic or applied is inappropriate.

Herner [17], using Bush's [18] definition of pure sciences (creation of new knowledge) and applied sciences (application of existing knowledge), found that pure scientists made more use of textbooks, monographs and research journals than applied scientists. Applied scientists made more use of trade publications, research reports, patents, standards., specifications and test codes.

Life/Nonlife

The third characteristic which emerged from Biglan's study was what he called the "life/nonlife" dimension. The life end of the dimension includes those studies that deal with inamate objects; the nonlife end includes those that deal with inanimate objects. As with pure-applied dimension, Biglan offered no further discussion nor definition of this characteristic.

A short elaboration is offered here. The components of this characteristic are perhaps more obvious than the first two. Its definition hinges on those of biology, life science, and social sciences, or those dealing with understanding of human problems on the one hand and that of inanimacy on the other.

What is notable in the definition of this characteristic is that the social sciences and biological sciences come together in their concern for "life". Without life, we have no social sciences. Hence, Biglan's comprehensive label "life system".

Also interesting is that, in Biglan's dimension, "inanimate" can include not only things like rocks and atoms, but abstract things like mathematical concepts. This suggests that scholars feel that some subjects may still be "inanimate" even though those subjects are purely the conceptualizations of living human minds. Also, this notion should be implicit in the definition, and is not contradictory.

As with the other two characteristics, a discipline's aggregate orientation may exist anywhere along a life/nonlife continuum.

Biglan found significant relationships between the hard/soft and pure/applied concepts and certain measures of scholarly output, such as publication of articles and technical reports. He found no significant relationship between the life/nonlife characteristic and output of scholars in the life and nonlife disciplines.

These distinctions should be reflected in the nature and scope of library collections and in use of those collections. Since student use of academic collections is by far the greater compared to use by scientific and scholarly faculty (because students outnumber faculty), three major

hypotheses relating student use of books and subject characteristics were formulated. They were,

Hypothesis 1: the lower the paradigm development of a discipline --that is, the softer the subject--the greater the number of books on that subject charged from the library. Conversely, the higher the paradigm development of a discipline--that is, the harder the subject--the fewer the number of books on that subject charged from the library;

Hypothesis 2: the more a subject can be characterized as applied, the fewer the number of books on that subject charged from the library, and the more a subject can be characterized as pure, the greater the number of books in that subject charged from the library;

Hypothesis 3: The more a subject can be characterized as life oriented, the greater the difference in number of books charged from the library between that subject and those characterized as nonlife oriented.

Since some correlation between these variables might normally be expected, and since Biglan found some interaction between the life/nonlife and the other two variables, two specific interactions were hypothesized.

Hypothesis 4: The more a life subject is pure, the greater the difference in number of books charged from the library between that subject and one which is nonlife and hard;

Hypothesis 5: The more a life subject is pure, the greater the difference in number of books charged from the library between that subject and one which is nonlife and applied.

Additionally, second and third order mathematical combinations were hypothesized.

Methodology

Subject book use consisted of total out-of-library circulation by undergraduate and graduate students for the fall semester of the 1974/75 academic year at the University of Southwestern Louisiana (U.S.L.).

"Books" were cataloged monographs; journals were excluded from the count. Reserve books were not counted. Subjects of circulated books were assigned to one of 63 academic departments according to whether the book's classification number matched those assigned to the academic department using the method described by McGrath and Durand [19].

Values for the three subject characteristics were determined for the 63 departments by a questionnaire sent to three random selections of U.S.L. faculty. Each of the three random groups received a different questionnaire, one each for the three characteristics. That is, each individual received one questionnaire on one of the three characteristics. The three groups of questionnaires contained one question each, but each faculty member was asked to judge each of 63 departments on a ten point scale on the characteristic in his questionnaire. The responses for a given department received were then averaged overall, so that each department received an aggregate score on each of the three characteristics. Rank scores appear in Tables 1, 2, 3. The general questionnaire is reproduced in Appendix I. Methods for checking reliability of scores will be treated in a separate paper.

Scores were correlated with those obtained by Biglan at the University of Illinois for 25 comparable academic disciplines. Results are shown in Table 4. The correlation coefficients suggest that in the aggregate, scholars and scientists at different institutions largely perceive the relationship of these disciplines to the three characteristics in the same way.

Variance of scores for 13 departments (see Table 1, 2 and 3) were considered too large and were dropped from the final analysis. They were Fine Arts, French German, History, Latin, Medical Record Science, Music, Philosophy, Physical Education, Spanish and Statistics.

Table 1

Rank Values For Hard/Soft Characteristic With Median

Rank	Discipline	Mean Value	
1	Mathematics	3.42	Hardest
2	Chemistry	3.41	
3	Electrical Engineering	3.36	
4	Chemical Engineering	3.28	
5	Physics	3.26	
6	Mechanical Engineering	3.21	
7	Civil Engineering	3.21	
8	Statistics	3.18	
9	Spanish	2.98	
10	German	2.92	
11	Microbiology	2.88	
12	Petroleum Engineering	2.81	
13	Computer Science	2.78	
14	Latin	2.78	
15	General Engineering	2.71	
16	Biology	2.67	
17	Accounting	2.65	
18	Geology	2.63	
19	French	2.49	
20	Horticulture	2.14	
21	Animal Husbandry	2.09	
22	Agricultural Engineering	2.04	
23	Dairy Husbandry	1.96	
24	Nursing	1.94	
25	Geography	1.84	
26	Agronomy	1.73	
27	Medical Record Science	1.69	
28	Library Science	1.63	
29	Aerospace Studies	1.50	
30	Agriculture	1.45	
31	Finance	1.37	
32	Office Administration	1.35	
33	Ind & Tech Educ	0.90	Median
34	Voc Agric Educ	0.87	
35	Business Communication	0.80	
36	General Business	0.72	
37	Economics	0.67	
38	Home Economics	0.61	
39	Management	0.59	
40	History*	0.38	
41	English	0.32	
42	Voc Ind Educ	0.26	
43	Music*	0.25	
44	Reading	0.24	
45	Marketing	0.21	
46	Architecture	-0.04	
47	Speech	-0.04	
48	Physical Education *	-0.14	
49	Law Enforcement	-0.16	
50	Health Education	-0.31	
51	Journalism	-0.36	
52	Art and Architecture	-0.53	
53	Special Education	-0.74	
54	Adult Education	-0.86	
55	Applied Arts	-0.95	
56	Dance	-1.20	
57	Education	-1.29	
58	Psychology	-1.32	
59	Sociology	-1.35	
60	Political Science	-1.35	
61	Philosophy *	-1.56	
62	Recreation	-1.64	
63	Fine Arts	-1.87	Softest

*Values for these departments were too unreliable for inclusion in the final analysis.

Table 2

Rank Values For Pure/Applied Characteristic With Median

Rank	Department	Mean Value		Rank	Department	Mean Value	
1	Medical Record Science	3.55	Applied	33	Horticulture	2.18	Median
2	Recreation	3.51		34	Agronomy	2.16	
3	Voc Ind Educ	3.47		35	Spanish	2.05	
4	Office Administration	3.46		36	Finance	2.03	
5	Voc Agric Educ	3.44		37	Electrical Engineering	2.00	
6	Nursing	3.36		38	Aerospace Studies	1.98	
7	Ind & Tech Educ	3.35		39	German	1.97	
8	Adult Education	3.24		40	General Engineering	1.91	
9	Accounting	3.22		41	Architecture	1.90	
10	Physical Education	3.19		42	Chemical Engineering	1.83	
11	Law Enforcement	3.14		43	French*	1.52	
12	Library Science	3.04		44	Art and Architecture	1.48	
13	General Business	3.01		45	English	1.39	
14	Home Economics	2.93		46	Computer Science	0.92	
15	Business Communicaiton	2.86		47	Music*	0.64	
16	Dairy Husbandry	2.85		48	Latin	0.32	
17	Applied Arts	2.80		49	Geography	0.28	
18	Journalism	2.74		50	Political Science	0.19	
19	Health Education	2.66		51	Statistics *	0.18	
20	Agricultural Engineering	2.65		52	Economics	0.14	
21	Speech	2.51		53	Sociology	0.05	
22	Special Education	2.49		54	Fine Arts*	-0.14	
23	Marketing	2.48		55	Geology	-0.21	
24	Animal Husbandry	2.47		56	History*	-0.33	
25	Management	2.42		57	Psychology	-1.72	
26	Education	2.40		58	Chemistry	-1.72	
27	Reading	2.35		59	Biology	-1.84	
28	Petroleum Engineering	2.35		60	Microbiology	-1.94	
29	Agriculture	2.30		61	Mathematics	-2.04	
30	Dance	2.25		62	Physics	-2.31	
31	Civil Engineering	2.23		63	Philosophy	-2.58	Pure
32	Mechanical Engineering	2.20					

* Values for these departments were too unreliable for inclusion in the final analysis.

Table 3

Rank Values For Life/Nonlife Characteristic With Median

Rank	Subject	Mean Value	
1	Nursing	4.02	Life
2	Biology	3.93	
3	Animal Husbandry	3.55	
4	Microbiology	3.44	
5	Dance	3.41	
6	Physical Education	3.37	
7	Recreation	3.30	
8	Sociology	3.30	
9	Dairy Husbandry	3.30	
10	Health Education	3.28	
11	Home Economics	3.08	
12	Special Education	3.04	
13	Education	3.02	
14	Agriculture	3.01	
15	Psychology	2.99	
16	Adult Education	2.79	
17	Horticulture	2.75	
18	Speech	2.74	
19	Law Enforcement	2.48	
20	Agronomy	2.48	
21	Reading	2.43	
22	Agricultural Engineering	2.32	
23	Voc Agric Educ	2.14	
24	Music	2.10	
25	Political Science	2.00	
26	English	1.86	
27	Business Communication	1.79	
28	Journalism	1.79	
29	Applied Arts	1.65	
30	Management	1.59	
31	History	1.58	
32	Fine Arts	1.52	
33	Voc Ind Educ	1.28	Median
34	Philosophy*	1.19	
35	Spanish*	1.01	
36	French*	0.76	
37	German*	0.73	
38	Marketing	0.39	
39	Art and Architecture	0.50	
40	Office Administration	0.21	
41	Architecture	0.00	
42	Latin*	-0.02	
43	Medical Record Science*	-0.12	
44	Ind & Tech Educ	-0.30	
45	General Business	-0.43	
46	Economics	-0.61	
47	Geography	-0.61	
48	Finance	-0.73	
49	Library Science	-0.93	
50	Geology	-1.16	
51	Petroleum Engineering	-2.08	
52	Chemistry	-2.13	
53	General Engineering	-2.17	
54	Aerospace Studies	-2.31	
55	Civil Engineering	-2.32	
56	Chemical Engineering	-2.47	
57	Accounting	-2.69	
58	Electrical Engineering	-2.71	
59	Mechnical Engineering	-2.90	
60	Statistics	-2.95	
61	Mathematics	-3.07	
62	Computer Science	-3.31	
63	Physics	-3.49	Nonlife

*Values for these departments were too unreliable for inclusion in the final analysis.

Table 4

Correlations of USL Values for the Three Characteristics With Those of the Biglan Study (University of Illinois)

Characteristic	Coefficient of Sample	Coefficient of Population[a]
Hard/Soft[b]	-0.78 *	-0.55 -- -0.90
Pure/Applied	0.78 *	0.55 -- 0.90
Life/Nonlife	0.86 *	0.70 -- 0.93

[a] Confidence level of 99%.

[b] Correlation is actually positive since USL responses were scored with a sign opposite to the Biglan Study.

* H_o: $\rho = 0$, rejected at .01, $n = 25$.

In addition to subject characteristics, it was expected that several demographic, program and resource variables would be highly associated with subject use. To assess the explanatory power of subject characteristics (X_1, X_2, X_3), these variables also had to be controlled or assessed. They are,

X_4: The total number of credit hours, not including extra course sections, taught by an academic department during the semester sampled. These hours include all levels of courses including those open to undergraduates and graduates.

X_5: The total number of lower level course enrollments.

X_6: The total number of upper level course enrollments.

X_7: The total number of masters level course enrollments.

X_8: The total number of Ph.D. level course enrollments.

X_9: Shelflist. For each subject category, the total number of shelf-ready, classified books in the library whose subjects match that subject category held by the library at the time of the survey.

$X_{\overline{10}}$: Dummy Variable for Ph.D. Program.

$X_{\overline{11}}$: Dummy Variable for Masters Program.

$X_{\overline{12}}$: Dummy Variable for Bachelor's Program.

$X_{\overline{10}}$, $X_{\overline{11}}$ and $X_{\overline{12}}$ are dichotomous variables. That is, a department received a 1 if it had a Ph.D. program, and 0 if it did not; likewise, if it had a masters or bachelors program.

Analytical procedure was stepwise multiple regression, in which the proportion of variance accounted for, $\bar{R}^2$, was the principle explanatory statistic. In this context, the linear regression model

$$Y = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

was first assumed, where

Y	is subject book use (circulation),
X_0	is a unity variable, i.e., it always equals 1,
X_1	is the hard/soft concept,
X_2	is the pure, applied concept,
X_3	is the life/nonlife concept,
$\beta_1, \ldots, \beta_3$	are the beta weights, and
ε	is an error term.

If the predictive aspects of subject characteristics were the sole interest, the regression model would have sufficed. However, the explanatory power of subject characteristics was of prime concern. Explanatory power can be determined by evaluating the "usefulness" of the three characteristics. According to Kerlinger and Pedhazur,

> we explain the variance of the dependent variable by indicating the relative contributions of the independent variables to the prediction of the dependent variable. [20, p. 99]

"Usefulness" is the amount of variance (ρ^2) each independent variable (each subject characteristic) contributes to the total variance ($\bar{R}^2$). It is defined by Darlington [21] as "the amount R would drop if that variable were dropped from the regression equation." The model is thus

$$\bar{R}^2_{Y \cdot ijk} = \rho^2_{Yi} + \rho^2_{Y(j \cdot i)} + \rho^2_{Y(k \cdot ij)} + \varepsilon,$$

where

ρ^2_{Yi}	is the squared simple correlation between Y and i,
$\rho^2_{Y(j \cdot i)}$	is the squared correlation between Y and j with the influence of i removed from j, and
$\rho^2_{Y(k \cdot ij)}$	is the squared correlation between Y and k, with the influence of i and j removed from k,

This model assumes that intercorrelations exist among the three characteristics.

Since other variables, such as the number of books the library holds and enrollments, were expected to have a heavy influence on subject use, the model was extended to take into account those which were significant. In other words contribution to variance by subject characteristics would be considered when these variables were controlled or entered into the equation first. Contribution to variance for this full model was

$$\bar{R}^2_{Y\cdot 1 \ldots 12}$$

where the numbers 1 . . . 12 represent all twelve independent variables.

Furthermore, to rule out the possibility that the relationships of the subject characteristics to subject book use might be nonlinear, the higher order model, consisting of second and third order powers, in all combinations, was postulated. The total number of combinations of the original three variables is 19. $\bar{R}^2$ for this model was

$$\bar{R}^2_{Y123\ \overline{14} \ldots \overline{28}},$$

Variables 1 to 3, and $\overline{14}$ thru $\overline{29}$, representing all combinations, are listed here.

X_1 = hard/soft	$X_{17} = X_1X_2$	$X_{23} = X_1X_2^2$
X_2 = pure/applied	$X_{18} = X_1X_3$	$X_{24} = X_1X_3^2$
X_3 = life/nonlife	$X_{19} = X_2X_3$	$X_{25} = X_2X_1^2$
$X_{14} = X_1^2$	$X_{20} = X_1^3$	$X_{26} = X_2X_3^2$
$X_{15} = X_2^2$	$X_{21} = X_2^3$	$X_{27} = X_3X_1^2$
$X_{16} = X_3^2$	$X_{22} = X_3^3$	$X_{28} = X_3X_2^2$
		$X_{29} = X_1X_2X_3$

The number of first, second and third order combinations is limited to 19 because that is the total whose exponents sum to a maximum of 3, the number of original variables.

Finally, to maximize correlation, all variables should have the same scale of measurement. Therefore, values for subject book use (measured on a ratio scale) were log transferred, to conform to values for the three subject characteristics (measured on an interval scale).

Results

Simple and partial correlations for the independent variables with circulation are shown in Table 5.

The stepwise regression procedure selects the highest correlation, and if the variable is statistically significant, enters it into the equation. Results are shown in Table 6. The first to enter was shelflist. After a variable is entered, the procedure then computes partial correlations (correlation of two variables when the influence of a third is removed) of the remaining variables with the dependent variable (subject book use). In the second, third and fourth steps, the highest significant partial correlations were those for masters level enrollments, hard/soft, and upper level enrollments, respectively. No correlations were significant after the fourth step. That is, these four variables accounted for maximum possible proportion of variance, under the conditions tested. When these variables were entered, remaining variables could not account for any additional variance. From the table, the following equation can be expressed:

Table 5

Correlations of All Independent Variables With

Subject Book Use (Circulation)

		Simple	Partial		
		(Step 1)	(Step 2)	(Step 3)	(Step 4)
1	Hard/soft	-0.20	-0.31	-0.32[c]	------
2	Pure/applied	-0.39	0.00	0.11	-0.01
3	Life/nonlife	0.07	0.17	0.15	-0.08
4	Credit/hours	0.69	0.31	0.14	0.22
5	Enrollments/lower	0.57	0.30	0.22	0.21
6	Enrollments/upper	0.67	0.26	0.16	0.25[d]
7	Enrollments/masters	0.45	0.40[b]	------	------
8	Enrollments/Ph.D.	0.38	0.21	0.08	0.18
9	Shelflist	0.81[a]	------	------	------
10	Ph.D. program	0.35	0.20	0.08	0.21
11	Masters program	0.41	0.10	-0.17	0.03
12	Bachelors program	0.41	.1	0.02	0.11

a highest simple r, sig. $.99F_{(1,47)} = 89.3$

b highest partial r, sig. $.99F_{(1,46)} = 8.75$

c highest partial r, sig. $.95F_{(1,45)} = 4.98$

d highest partial r, sig. $.90F_{(1,44)} = 3.01$

Table 6

Summary of Stepwise Regression Procedure

Showing Significant Increases in R Square, First-Order Model

Variable	Cumulative R		Increase in R Square	F	Significant
	R	R Square			
9 Shelflist	0.809	0.655	0.655	89.30	***
7 Masters Enrol.	0.843	0.71	0.0551	8.75	***
1 Hard/Soft	0.86	0.74	0.03	4.98	**
6 Upper Level Enrol.	0.87	0.76	0.02	3.01	*

*** $.99^{F}(1, 47)$, $.99^{F}(1, 46)$

** $.95^{F}(1, 46)$

* $.90^{F}(1, 44)$

$$R^2_{Y\cdot 9716} = r^2_{Y9} + r^2_{Y(7\cdot 9)} + r^2_{Y(1\cdot 97)} + r^2_{Y(6\cdot 971)}$$

$$= 0.65 + 0.055 + 0.028 + 0.02$$

$$= 0.76.$$

The meaning of this equation is: 65% of the variance of circulation by subject can be accounted for by the shelflist; 5.5% can be accounted for by masters enrollments; and 2.8% can be accounted for by the hard/soft characteristic after the effect of both the shelflist and masters enrollments have been removed from hard/soft. An additional 2% can be accounted for by upper level enrollments. Another way of saying this is: given that shelflist is already in the equation, masters enrollments accounts for 5.5%; given that shelflist and masters enrollments are in the equation, hard/soft accounts for 2.8%; and so on, for upper level enrollments.

It is important to note that although all nine demographic variables had higher initial correlations than that for hard/soft, none had significant partial correlations after shelflist and masters enrollments had been entered. In fact, had not hard/soft been entered in step 3, the stepwise procedure would have been halted leaving only shelflist and masters level enrollments in the equation. Upper level enrollments became significant again, but only after hard/soft was entered. The pure/applied and life/nonlife characteristics were not significant under these conditions. In other words when the strong variables, shelflist and masters level enrollments were controlled, only the hard/soft characteristic was significant.

In the 3-variable model, the influence of the strong variables are deliberately ignored, in an attempt to determine how much variance the three characteristics accounted for by themselves. The 3-variable explanatory model was intended to sort out the intercorrelations expected to exist between the three characteristics. These intercorrelations are shown in Table 7.

Table 7

Intercorrelations Between the Three Characteristics

	Coefficient of Sample	Coefficient of Population[a]
Hard/Soft with Pure/Applied	-0.32	-0.54 -- -0.05
Hard/Soft with Life/Nonlife	-0.65	-0.78 -- -0.47
Pure/Applied with Life/Nonlife	0.19	-0.08 -- 0.45

[a] Confidence level of 95%, n = 49.

Simple and partial correlations used in the stepwise regression procedure are shown in Table 8. The subject characteristic with the highest simple correlation, pure/applied (-0.388), was entered into the equation first. The partial correlation for hard/soft was then examined and found significant. Hard/soft was thus entered. The next partial correlation, -0.096 for life/nonlife, was not significant and not entered. The contribution to variance for the three characteristics is shown in Table 9. The total significant contribution to variance was 0.26.

Simple and partial correlations for interactions and higher order combinations are shown in Table 10. The stepwise regression procedure was also used for examining the usefulness of these combinations. From the table it is seen that only the interaction between hard/soft and pure applied (variable $X_{\overline{23}}$, $X_1X_2^2$) was entered. No other interaction or higher order was significant after $X_1X_2^2$ was entered. The interaction is complex since the pure/applied characteristic was squared. Its contribution to variance is shown in Table 11. Since its contribution, $R^2 = 0.23$, is less than the total contribution when the two characteristics are entered separately, the usefulness of the interaction is less satisfactory in explaining subject circulation. the value of 0.23 is the largest obtained by examining interactions and higher order combinations, whereas 0.26 was the highest obtained without them.

Results of Hypotheses 1, 2 and 3 can be ascertained from the correlations and their signs for the three characteristics and subject use. From Table 1, subjects at the high end of the hard/soft scale were considered "hard" and those at the low end "soft." Therefore a negative correlation would indicate support for Hypothesis 1. From Table 12, it is seen that the simple correlation for hard/soft was not significant. But when

Table 8

Simple and Partial Correlations Between Circulation And the Three Characteristics

	Simple	Pure/Applied Held Constant	Pure/Applied and Hard/Soft Held Constant
Pure/Applied	-0.388 *	----	----
Hard/Soft	-0.194 n.s.	-0.36 *	----
Life/Nonlife	0.071 n.s.	0.16 n.s.	-0.096 n.s.

* $p < .05$

Table 9

Summary of Stepwise Regression Procedure

Showing Increases in R Square

When the Three Characteristics Are Entered First, First-Order Model

Variable	R	Cumulative R Square	Increase in R Square	F	
Pure/Applied	0.39	0.15	0.150	8.32	**
Hard/Soft	0.51	0.26	0.112	7.01	*
Life/Nonlife	0.52	0.27	0.001	0.42	n.s.

** $.99^{F}$ (1, 47)

* $.95^{F}$ (1, 46)

Table 10

F-Levels, Simple and Partial Correlations

For Higher Order Combinations of the Three Characteristics

In the Stepwise Regression Procedure

	Variable	Simple Correlation	Partial Correlation	F to Enter[a]
1	X_1 Hard/Soft	-0.19	-0.098	0.446
2	X_2 Pure/Applied	-0.39	0.023	0.025
3	X_3 Life/Nonlife	0.07	-0.00	0.000
14	X_1^2	-0.15	-0.07	0.267
15	X_2^2	-0.41	-0.01	0.004
16	X_3^2	0.10	0.01	0.007
17	X_1X_2	-0.47	-0.06	0.183
18	X_1X_3	-0.10	-0.10	0.476
19	X_2X_3	-0.16	-0.05	0.110
20	X_1^3	-0.12	-0.06	0.140
21	X_2^3	-0.41	-0.03	0.050
22	X_3^3	0.12	0.03	0.044
23	$X_1X_2^2$	-0.48 entered[b]	-----	-----
24	$X_1X_3^2$	-0.01	-0.05	0.137
25	$X_2X_1^2$	-0.37	-0.01	0.007
26	$X_2X_3^2$	-0.07	-0.03	0.056
27	$X_3X_1^2$	-0.16	-0.13	0.801
28	$X_3X_2^2$	-0.26	-0.08	0.287
29	$X_1X_2X_3$	-0.33	-0.12	0.767

[a] Not significant at .90 $F(1, 47) = 2.82$.

[b] See Table 4.19.

Table 11

Summary of Stepwise Procedure Showing R Square When the Three Characteristics and Their Higher-Order Combinations are Entered First

Variable	R	Increase in R Square	F
$\underline{23}\ X_1 X_2^2$	-0.48	0.23	13.97 *

* $.99^F$ (1, 47)

Table 12

Simple and Partial

Correlations Between Circulation and Three Characteristics.

With Shelflist and Masters Enrollments Controlled (Held Constant)

	Simple	Partial: Controlling Shelflist	Partial: Controlling Shelflist and Masters Enrollment
Hard/Soft	-0.194 n.s.	-0.308 *	-0.316 *
Pure/Applied	-0.388 *	0.002 n.s.	0.115 n.s.
Life/Nonlife	0.071 n.s.	0.167 n.s	0.15 n.s.

* $p < .05$

shelflist and masters enrollments were controlled, the correlations (-0.308, and -0.316) became significant and, being negative, tend to support Hypothesis 1. As scores for hard/soft decrease--i.e., go from hard to soft--subject book use increases. Hard/soft also became significant (-0.36) when pure/applied was held constant (Table 8).

From Table 2, subjects at the high end of the scale were applied and those at the low end pure. As with hard/soft, a negative correlation from pure/applied would indicate support for Hypothesis 2. The simple correlation for pure/applied was both significant and negative, tending to support Hypothesis 2, when shelflist and masters enrollments were controlled. When these strong variables were controlled, however, pure applied was not supported.

Correlations for life/nonlife were not significant under any of the conditions tested.

From Table 10, the correlations for variables $\overline{18}$ (X_1X_3) and $\overline{19}$ X_2X_3), representing the interactions tested under Hypotheses 4 and 5, were not significant. Thus, Hypotheses 4 and 5 were not supported.

Table 13 summarizes the findings for the original five hypotheses.

Summary of Findings

1. The hard/soft characteristic is significantly correlated with subject book use when shelflist and masters enrollments are held constant. It accounts for a small but significant amount of variance (2.0%) when the effect of shelflist and masters enrollments are removed from it.

Table 13

Support of Original Hypotheses

In Terms of Three Models

Model	H_1 Hard/Soft	H_2 Pure/Applied	H_3 Life/Nonlife	H_4 Inter-action	H_5 Inter-action
Full First-order with Demographic Variables Controlled	weak	none	none	not tested	not tested
Three variable model excluding Demographic Variables	conditional[a] modest	conditional[a] modest	none	not tested	not tested
Higher-order excluding Demographic Variables	conditional[a]		none	none	none

[a] on the condition that other variables are not controlled

2. No other tested variables contributed significant amounts of variance to subject use after the proportions of variance for shelflist, masters enrollments, hard/soft and upper level enrollments were computed.

3. The pure/applied characteristic is significantly correlated with subject book circulation. When other strong variables are not controlled, it accounts for 15% of the variance.

4. The hard/soft characteristic is not significantly correlated with subject book circulation, when other strong variables are not controlled. However, when pure/applied is controlled, it is significant, and accounts for 11% of the variance.

5. Together the hard/soft and pure/applied characteristics can account for about 26% of the variance of subject book circulation when other strong variables are not considered.

6. The life/nonlife characteristic is not significantly correlated with subject book circulation. It does not account for a significant portion of the variance. Though it is significantly correlated with hard/soft, it does not interact with hard/soft or pure/applied.

7. The hard/soft and pure/applied characteristics interact in a complex way to affect subject book circulation. Specifically, as the combined value of these two characteristics decreases, subject book circulation increases. However, the inherent complexity of the interaction is an argument against its usefulness, especially since it accounts for less variance than the two characteristics considered separately.

8. All other higher-order combinations and interactions are not significant.

9. Hypothesis 1 (hard/soft) is weakly supported when shelflist and masters enrollments are controlled, and shelflist and masters enrollments are not. It is moderately supported when only pure/applied is controlled.

10. Hypothesis 2 (pure/applied is not supported when shelflist and masters enrollments are controlled. However, it is moderately supported when other variables are not controlled.

11. Hypothesis 3 (life/nonlife) is not supported.

12. Hypothesis 4 (interaction of life/nonlife and hard/soft) is not supported.

13. Hypothesis 5 (interaction of life/nonlife and pure/applied) is not supported.

Discussion

It was suggested earlier in this paper that knowledge of the relationship between characteristics of subject matter and use of library books would help to point the way toward a rationale for building book collections. The rationale would emerge from insights gained from sociological explanation--i.e., from analysis of collective behavior of scholars, scientists or students in their pursuit of knowledge or applications of knowledge. Hopefully, explanation would be intuitively as well as empirically satisfying. Explanation would be achieved by studying the variance in book use accounted for by subject characteristics. Ideally, for complete explanation, total accounted-for variance would be as close to 100% as possible. No such variance was anticipated nor computed, however. Indeed, the highest variance found, under a no-control condition, was 26%, and thus explanation must be considerably qualified.

At once, two major qualifications must be mentioned: (1) the group studied, and (2) conditions of control. The first qualification is that subject book use was by graduate and undergraduate students. Faculty use was not considered, and graduate use was largely at the masters' level.

The second qualification concerns the drop in variance when books in the library and number of enrollments were considered. The variance contributed by hard/soft dropped from 11% to 2%; that by pure/applied from 15% to 0%. Since the 2% for hard/soft was significant, it lends some support to Kuhn's contention that workers (in this case, university students) in disciplines with well-developed paradigms use fewer books than those in disciplines with less developed paradigms. The support found here is far from conclusive for at least two reasons: (1) 2% is very low, and (2) for a complete test of Kuhn's hypothesis, use of books and journals should be considered in relationship to each other.

When the definition of the hard/soft characteristic is examined, behavioral manifestations of hard and soft disciplines seem self-evident. Storer [10, p. 237] wrote that precision of central concepts of a discipline is much lower when defined in words rather than numbers. Fields in which knowledge is organized with considerable precision--i.e., highly quantified--are hard, and those with low precision are soft. It seems intuitively consistent that greater precision takes less space, and fewer books. Conversely, a search for information in a soft discipline would require perusal of a greater amount of textual space--i.e., more books.

The drop in variance from 15% to 0% for the pure/applied characteristic suggests that number of books held by the library and number of enrollments must be highly correlated with the pure/applied characteristic. If this is the

case, one measure of the pure/applied dimension then might be simply the absolute number of persons working in or studying the particular discipline.[1] Number of enrollments at the upper and graduate levels might well serve as this measure. That is, pure/applied is correlated with subject book use only because number of enrollments is correlated with subject book use. The specific finding of greater circulation of books in pure subjects, were it so, should agree with Herner's [17] findings that pure scientists made greater use of monographs and research journals than applied scientists, though the data are insufficient to be conclusive.

Though the relationship found between pure/applied and subject use of books was in the direction hypothesized, the argument and the findings were weak. Why the pure/applied characteristic is not cleanly correlated with subject book use is not entirely apparent. If anomalies of the data are not responsible, it might be that pure/applied is less a characteristic of the subject matter than it is of the individuals working on the subject. Anomalies of the data, poor definition, biased responses, biased circulation are other reasons which could account for the lack of stronger relationship. In any case, the uncertain relationship with use of books should not imply that a firmer relationship cannot be found.

As in Biglan's study, no relationship was found between the life/nonlife characteristic and the dependent variable. In Biglan's study, one dependent variable was scholarly output. That is, life systems did not differ significantly from nonlife systems on such things as publication of monographs, journal articles, technical reports and dissertations. The agreement between the two studies is essentially this: not only is there no difference in

1. Storer proposed that "the most important dimension of social variation is the proportion of each discipline's members who are engaged in applied activities rather than in basic research and teaching." [8, p. 1879].

scholarly output (number of publications) between life or nonlife disciplines, there is also no correlation between number of books used and life/nonlife disciplines. Uniformity in scholarly output by teachers and researchers in life and nonlife subjects is reflected in uniformity of number of books used by students in those subjects. The lack of relationship was not unexpected since little argument could be summoned for one or the other possibilities. The test was necessary, however, since the life/nonlife dimension was clearly delineated by Biglan and seen to have behavioral correlates, though differences in amount of scholarly output was not among them. As with the pure/applied dimension, an undiscovered relationship between life/nonlife characteristic and use of books should not imply that one does not exist. The agreement with Biglan's finding, however, limits the likelihood of finding a significant relationship between life/nonlife and use of books.

There seemed to be more reason to expect interactions between the life/nonlife characteristic and the two other characteristics, though none was found. Biglan's finding, that life science scholars' preference for working with people was more pronounced in the soft/applied areas than in hard/pure areas, ought to have implications for scholars' use of books. Working with people, and use of books are two forms of communication and should be correlated. This hypothesis was not tested, of course. Instead it provided the argument that both should be correlated with the life/nonlife characteristic. There is no doubt that life/nonlife is correlated strongly with the hard/soft characteristic and somewhat with the pure/applied characteristic, but these relationships do not appear to affect subject use of books.

The only interaction which does affect subject book use is that between hard/soft and pure/applied. But, their joint effect is less than their additive effects. The reason for this is not clear.

The lack of complex statistical relationships (as hypothesized in higher-order combinations) between the three characteristics and subject book use simplifies explanation. Put another way, no relationship requires no explanation, especially since no prior studies showing complex statistical relationships were found. The relationships were strictly linear.

The substance of the explanatory finding is that only the hard/soft and pure/applied characteristics have a relationship to subject use, but, not strongly, and in different ways.

Variability in subject book use is partly due to degree of development of a discipline--the cultural state of its paradigm. The paradigm may be either or both Kuhnian or Mertonian. The variability is also partly due to the different goals of a discipline, i.e., with respect to investigation of knowledge for its own sake, or for the sake of some practical social purpose. These two things, hard/soft and pure/applied, by no means account for all of the variability. They are not strong enough by themselves to provide a complete rational base for collection building. Yet their very significance indicates that further analysis of subject characteristics may prove useful. A closer analysis of definition may reveal behavioral correlates which should be more reliable than judgmental measures. As they relate to social behavior, they hint at sources of explanation for subject use.

For example, the three characteristics correlate one way or another with what were defined as demographic or program variables. Redefined, these variables--books in the library, enrollments, credit hours--could be regarded

as behavioral variables. Surely, some social force influences fluctuations in enrollment from subject to subject.

Can the findings of this study help to provide a rationale for building library collections? Yes, to some extent. But we need to look further for additional variance.

Use of subject characteristics would have greater theoretical justification in a rationale for collection building if the variance they account for were larger. The ones studied here are certainly not sufficient for full explanation. Additional variance may well be found in other characteristics and by better definition. Since there is some indication that problems of measurement are at least partially responsible for this limited variance, further analysis is warranted.

It is clear, however, that both the hard/soft characteristic and the pure/applied characteristic, when considered in relation both to what the library already holds and to number of enrollments, may be modestly useful in an a priori evaluation of a collection building philosophy.

It can be argued that, in view of the cultural and social relationships between individuals working in or interested in a particular subject, it is perfectly normal and to be expected that relatively more books in some subjects would be used than in others, and that book selection consider these relationships. That is, collection building ought to be based, at least partially, on cultural and sociological requirements of disciplines rather than on misunderstood or ill-defined economic schemes such as Farmington Plans or blanket orders with commercial or university presses. Schemes whose only intention is to guarantee acquisition of as many diversified titles as possible without regard to university programs and without regard to differences between disciplines will not be wholly satisfactory.

It should be clear that the disciplines do differ, that the differences involve both the nature of the subject matter, and the scientific or scholarly behavior of the persons involved with the subject matter, and that the differences are measureable. The behavior may have manifestations in output, as studied by Biglan or in use of that output as studied here. When use is the criterion, it has immediate interest for library collections. When the relationships between use and subject matter are clear, the rationale begins. Cultural and sociological analysis of disciplines should reveal some of those relationships.

Further Research

Correlations might be raised by more careful definition of the characteristics, better operationalization, and better measurement. Life/nonlife might be redefined as four or more variables, distinquishing between social, biological, human and animate characteristics. The meaning of intercorrelations between hard/soft, pure/applied and life/nonlife might be explored. Behavioral alternatives to judgmental measures should be sought.

Other characteristics might be found in the literature of psychology and sociology of science. Some possibilities are: creative, empirical, exact/inexact, abstract/concrete, service/nonservice, physical/non-physical, prestige and interest.

For a full test of Kuhn's hypothesis, the interrelationship between book and periodical use should be examined. The meaning of paradigm development as it involves differences in the learning, teaching and research process between students and faculty, should also be examined.

A major question involves the cybernetic relationship between books already in the library and books used. That is, to what extent do books used determine which books the library selects? And to what extent do books already owned by the Library determine which are used? And what are the delimiting variables?

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Departmental Code: ____

Disciplines: Are they hard or soft or somewhere in between?

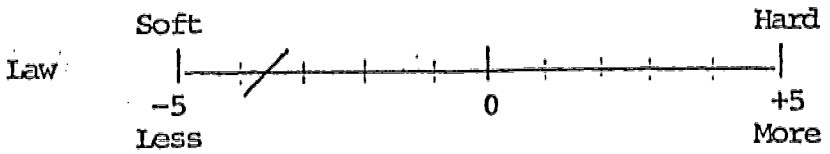
Scientific and scholarly fields are often said to vary in their development or maturity. That is, some fields have a larger body of accepted laws, theory and agreed-upon methodology. The more mature a field, the more of these things they share and agree on. Fields with much agreement are often called "hard" and those with little agreement often called "soft."

On the next two pages is a list of academic fields in which courses are taught here at USL. Next to each line PLACE A MARK which best indicates your answer to the following.

From your own knowledge of each field, how much do you think its members agree upon or share whatever laws, theory and methodology it may have?

Example:

A mark to the left indicates less agreement, or "soft;" one to the right, more agreement, or "hard;" one near the center indicates not clearly one nor the other.



Departmental Code: ____

Disciplines: Are they pure or applied
or somewhere in between?

Scientific and scholarly fields are often said to be either pure or applied. One scholar defined pure science as

> basic and experimental research, expressing a need to know, understand or explain.

and applied science

> active engagement in finding practical applications of what has previously been experimentally discovered, determined or revealed.

Few scholars would agree that a field is entirely pure or entirely applied, and that most, if not all fields, fall somewhere in between.

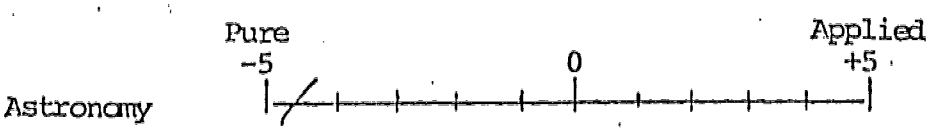
On the next two pages is a list of the academic fields in which courses are taught here at USL. On the line next to each subject, PLACE A MARK at whichever point best indicates your answer to the following.

> From your own knowledge of each field, to what extent would you say the field is pure or applied?

Please mark each field including those you would not normally regard as science.

Example:

A mark to the left indicates it is more pure than applied; a mark to the right indicates it is more applied than pure. A mark near the center indicates either a balance, or not clearly one or the other.



Departmental Code: ____

Disciplines: Are they concerned with life systems or nonlife systems or something in between?

Scholars and scientists often make sharp distinctions between academic disciplines which are concerned with "life" systems and those concerned with "nonlife" systems. Life systems may include social as well as biological areas. Nonlife systems would include areas concerned with the study of the abstract and inanimate objects. The distinction seems obvious perhaps. Most subject areas seem clearly one or the other. But some subjects may include elements of both life and nonlife systems--biophysics, for example.

On the next two pages is a list of the academic fields in which courses are taught here at USL. Next to each subject is a line. On each line, PLACE A MARK at whichever point best indicates your answer to the following.

From your own knowledge of each field, to what extent would you say the field is life-oriented or non-life-oriented?

Example:

A mark to the left indicates the field includes more nonlife than life concerns; a mark to the right indicates more life than nonlife concerns; a mark near the center indicates either a balance, or not clearly one or the other.