Relevance Auras:

Macro Patterns and Micro Scatter

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Empirical analysis of relevance assessments can illuminate how differ groups of readers perceive the relationship between bibliographic records and index terms. Reported here is an experiment that harvested relevance assessments from two groups, engineers and librarians. These groups assessed the relevance relationships between bibliographic records and index terms for three literatures: engineering, psychology and education. Not only was the indexer-selected term (the topically relevant term) assessed, but also broader, narrower and related terms. Figures 1 - 8 show these terms arranged as two-dimensional term domains. Positive relevance assessments plotted across the two-dimensional term domains revealed regular patterns, here called "relevance auras." A relevance aura is a penumbra of positive relevance, emanating from a bibliographic records across a term domain of broader, narrower and related index terms. This experiment attempted to compare the relevance auras produced by engineers and librarians at both a macro and micro level of aggregation.

This experiment showed that relevance auras appear in data aggregating reader groups and literatures. Mico analyses of individual records, however, showed that relevance auras were ragged or did not develop. Agreement in relevance assessment appears on the individual term basis and often independently of the formation of any relevance aura.

Relevance Assessment

Mizzaro's (1997) review of the history of relevance studies reveals both the centrality of the concept, as well as how little progress has been made in its definition and quantification. Green considers the use of the term relevance to be in "disarray" (1995, p. 647), citing problems of both theoretical definition and operational measurement.

This experiment premises that assessing the relevance of an index term for a bibliographic record is an act of reading that occurs within a cultural context. Transactional reading theory suggests that no two readers will ever generate exactly the same meaning from a text because they bring different backgrounds to the act of interpretation (Straw, 1990). Hjorland and Albrechtsen (1995) stress the effect of language communities on the interpretation of text in their domain-analytic paradigm. This experiment also assumes that harvesting and comparing relevance assessments reveals, in part, the fundamental phenomenon of verbal scatter. In short, people tend to disagree about the names of things (Furnas, et al., 1983). Therefore it is not surprising to find online searchers disagreeing with the indexer's choice of terms. Farrow (1991) reminds us that there is no psychological basis for indexing. Thus, sources of variation in empirical experiments comparing relevance assessments include not only differences between language communities, but also disagreements with indexer-chosen terms. To search online engages one not only in a two-way "conversation" with the database, but in a three-way conversation where the third speaker is the ghostly indexer. The indexer effect lingers as a confounding variable that interferes with the measurement of the differences between language communities.

Standard thesauri and subject heading lists provide a starting point for the investigation of verbal scatter and relevance assessment. These tools conveniently arrange terms in relationships other than just topicality (Green, 1995). This experiment used narrower terms, broader terms and related terms, arranged in two-dimensional term domains. Mapping the positive relevance assessments on to a two-dimensional term domain creates a relevance aura.

The Semantic Distance Model

Brooks (1995, 1997, 1998) introduced the Semantic Distance Model (SDM) to explain consistent relationships observed in a series of experiments between relevance assessments and semantic distance. The *semantic distance effect* of the SDM suggests that relevance assessments decline systematically with greater semantic distance. The *semantic direction effect* of the SDM suggests that the distance to nonrelevance depends on the direction of assessment up or down a term hierarchy.

Semantic distance is a psychological construct that has been used to locate concepts along various dimensions of meaning (Schvaneveldt, Durso & Mukherji, 1982). The following experiment found broader, narrower and related term relationships in the INSPEC Thesaurus, the Thesaurus of ERIC Descriptors, and the Thesaurus of Psychological Index Terms. Each source provided two term hierarchies five terms deep. The top term in each hierarchy located a bibliographic record (here called a "top" record). Similarly, the bottom term in the hierarchy located a "bottom" record.

The related terms in each term domain were simply the first related term list for each term in the vertical hierarchy. In turn, the first related term listed produced a related term and so on. Figures 1 - 8 show the two-dimensional term domains of the INSPEC Thesaurus and the Thesaurus of ERIC Descriptors . Each table exhibits either the top or bottom bibliographic record, the term hierarchies (in the left-most column), and the related terms that fill out the two-dimensional term domain.

A computer program collected relevance assessments by randomly presenting each bibliographic record paired with each of the twenty associated index terms in each table. Averaging relevance assessments produced either a positive or negative mean relevance assessment. Relevance auras were constructed by mapping positive mean relevance assessments over the two-dimensional term domains.

Research Questions

The semantic distance effect of the SDM predicts that relevance assessment will decline with semantic distance. This effect will be demonstrated if the indexer-chosen "topical" index term is assessed most highly, while more distant terms will be systematically devalued.

The semantic direction effect of the SDM predicts that the distance downward to nonrelevance is shorter than the distance upwards to nonrelevance. This effect will be demonstrated by comparing the distance to nonrelevance for top and bottom records. The distance to nonrelevance (here defined as negative mean relevance assessment) for top records should be shorter than the distance to nonrelevance for bottom records.

This experiment hypothesizes that relevance auras will emanate from a bibliographic record in consistent pattern. The aura of a top record should extend sideways and downwards in an arc across a two-dimensional term domain. The aura of a bottom record should extend sideways and upwards in an arc across a two-dimensional term domain. The research premise is that consistent differences in the relevance auras between librarians and engineers are evidence of differences in their discourse communities.

Subjects

The "librarian" group was twenty-eight master-degree students of a school of library and information science. The "engineers" group was twenty-eight mechanical engineering students (eight doctoral students, eight master-degree students, and twelve bachelor-degree students).

Experimental Equipment and Procedures

A computer program presented a bibliographic record and a randomly chosen index term. Subjects expressed their relevance assessments by moving a light bar over an unmarked scale. Subjects evaluated either the top or bottom bibliographic record, but not both, for any given term domain. Relevance assessments were normalized to z scores and aggregated. Mean z scores were found for each index term in a two-dimensional term domain. Arbitrarily, positive mean z scores were defined as positive relevance assessment, and negative mean z scores were defined as negative relevance assessment. Evidence of the SDM was found by comparing mean relevance assessments. Relevance auras were created by mapping the pattern of positive mean relevance assessments on to the two-dimensional term domains.

Results

The Semantic Distance Model

Table 1 presents mean relevance assessments for the vertical dimension for the term hierarchies (the left-most column in each table). Beginning with the indexer-chosen term (0.97), the mean relevance assessments decline systematically (0.22, 0.17, 0.12). The aggregate data appear to display the semantic distance effect predicted by the SDM.

Table 1 also aggregates the related term assessments for the top and bottom records for each table (this is the horizontal dimension extending from each top and bottom term). Beginning with the indexer-chosen term (0.97), the mean relevance assessments decline systematically (0.25, -0.07, -0.09). The presence of the semantic distance effect in both vertical and horizontal dimensions implies the existence of well-formed relevance auras for aggregate data.

The Relevance Aura of Three Literatures

Relevance assessments from three literatures afforded the greatest level of abstraction, therefore the greatest possibility of observing well-formed relevance aura.

Top Records

Table 2 displays the relevance aura of the top records of the ERIC, INSPEC and Psychology literatures. Relevance assessments decline systematically with semantic distance in both the horizontal and vertical dimensions. The relevance aura, defined as the portion of the table with positive relevance assessments are limited to just the vertical and horizontal dimensions. None of the internal descriptors were considered relevant. Thus, a well-formed relevance aura for top records did not appear.

Bottom Records

Table 3 displays the relevance aura of bottom records for three literatures. Positive relevance assessments extend upward four semantic steps and one step horizontally. Positive relevance assessments fan outwards with some scatter. Bottom records for the aggregated data form a wide, but inconsistent relevance aura.

The semantic direction effect of the SDM predicts that the distance downward to nonrelevance is shorter than the distance upwards to nonrelevance. Table 2 illustrates that nonrelevance is reach at two semantic steps below top records; Table 3 illustrates terms four semantic steps above bottom records are assessed as relevant. Therefore, as predicted, the distance downwards to nonrelevance is shorter than the distance upwards.

Micro Analysis of Top Records

INSPEC Top Records

Figure 1 presents the relevance auras given by engineers and librarians for INSPEC record 5279409. There is great similarity in assessments by engineers and librarians for this record. Presumably both groups were influenced by the word "assembly" in the first sentence of the abstract. The librarians rated "Integrated Circuit Technology" positively, but it is not statistically different ($p < .18$) from the negative rating given this term by the engineers.

Figure 2 presents the relevance auras given by engineers and librarians for INSPEC record 00916781. The relevance aura colors many cells in this two-dimensional term domain, although the symmetry is disturbed because both groups consider "Fission Reactors" as negative. The two groups differ in their assessment of "Atomic Beams", but the difference is not statistically significant ($p < .27$).

There appears to be great overlap between librarians and engineers in their relevance assessments for the INSPEC top records, but the relevance assessments form ragged relevance auras.

ERIC Top Records

Figure 3 presents the relevance auras for ERIC record EJ516093. Both groups scattered positive relevance assessments throughout the tables. The five terms that produced disagreement were: Generative Grammar ($p < .23$), Anthropological Linguistics ($p < .18$), Syntax ($p < .17$), Cultural Context ($p < .06$) and Form Classes (Languages) ($p < .06$). Only the last two approach statistical significance.

Figure 4 presents the relevance auras for ERIC record EJ515482. Here the librarians disagree with both the engineers and the indexers by assessing all terms as negative. The two terms separating the engineers and librarians are not statistically significant: Logic ($p < .40$) and Logical Thinking ($p < .24$).

It appears that the INSPEC top records produced more aggreement between librarians and engineers than the ERIC top records. The latter witnessed not only disagreement between the two groups, but also disagreement between librarians and indexers.

Micro Analysis of Bottom Records

Engineering Bottom Records

Figure 5 presents the relevance auras for INSPEC record 5285612. Both groups scatter positive relevance assessments throughout the tables with complete agreement. Both disagree with the indexer by rating the topically relevant term negatively.

Figure 6 presents the relevance auras for INSPEC record 5282573. This record casts a broad relevance aura over many of the terms for both groups. Differences between the two groups are centered on only two terms: Fission ($p < .53$), and Charge Exchange ($p < .05$). The difference created by the last term attains statistical significance and implies a real difference in understanding what "Charge Exchange" may mean between the groups.

Education Bottom Records

Figure 7 presents the relevance auras for ERIC record ED207581. These auras tend to cluster around the topical term, with the exception of Transformation Generative

Grammar (p < .01). Linguistic Theory (p<.01) also generates a significant difference between the groups. Other term differences, Association Measures (p < .26) and Contrastive Linguistics (p < .57), are not significant.

Figure 8 presents the relevance auras for ERIC record EJ449288. These auras tend to cluster around the topical term with differences in only three terms: Abstract Reasoning (p < .1), Comprehension (p < .19) and Algebra (p < .49).

The bottom records appear to be generating more positive relevance assessments and more agreement between engineers and librarians than do the top records

Discussion

This experiment presented index terms and bibliographic records from three literatures to two groups of readers. One ambition of this study was to find evidence of the Semantic Distance Model. The aggregate data showed, as expected, the semantic distance effect and the semantic direction effect of the SDM. The aggregate data are manifesting anticipated characteristics of the SDM.

The second ambition of this study was to find well-formed relevance auras, and to interpret differences in relevance auras as differences between discourse communities. This ambition was generally frustrated. Positive relevance showed wide variation and scatter in the micro analysis of the relevance auras of individual records. It may be argued that top records showed slightly more agreement between librarians and engineers. On the other hand, the bottom records generate more positive relevance assessments, but also more statistically significant differences between librarians and engineers. No clear pattern emerged from the micro analyses.

This study may have made two contributions to the relevance literature. First, it illustrated that discourse community analysis should probably proceed at the term level. The scatter of the results indicates that larger patterns such as relevance aura are produced inconsistently. Secondly, this study comments on the methodological difficulties in charting systematic differences between discourse communities. Devices used to illuminate differences between discourse communities such as standard thesauri may themselves provoke disagreement with indexer-chosen terms and term hierarchies. Creating two-dimensional term hierarchies by arbitrarily selecting the first-listed related term, the method used in this study, probably contributes to the production of ragged relevance auras.

The construct of relevance auras - systematic displays of positive relevance auras over two-dimensional term displays - awaits a more definitive experiment based on an artful construction of the two-dimensional term domains.

References

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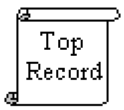
Table 1: Relevance Assessments and Semantic Distance

	Semantic Distance			
	0	1	2	3
Vertical Distance	.97	.22	.17	.12
Horizontal Distance	.97	.25	-.07	-.09

Cell values are mean z scores, N = 224

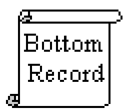
Table 2: Relevance Aura of Top Records for Three Literatures

Vertical Semantic Steps	Horizontal Semantic Steps 0	1	2	3
0	 **1.04**	**.15**	**.13**	**-.08**
1	**.21**	-.18	-.37	-.54
2	**-.20**	-.57	-.41	-.39
3	**-.40**	-.31	-.34	-.63
4	**-.41**	-.23	-.31	-.33

Relevance Aura: Shaded Relevance Assessments
Semantic Distance Model: Bold Relevance Assessments

Cell values are mean z scores, N = 168

Table 3: Relevance Auras of Bottom Records for Three Literatures

Vertical Semantic Steps	Horizontal Semantic Steps			
	0	1	2	3
4	.71	.05	-.12	-.33
3	**.45**	-.13	-.02	-.48
2	**.65**	.05	-.25	.00
1	**.83**	.65	.22	-.20
0	**1.21** 	**.98**	**-.02**	**-.04**

Relevance Aura: Shaded Relevance Assessments
Semantic Distance Model: Bold Relevance Assessments

Cell values are mean z scores, N = 168

Figure 1: Relevance Assessments for INSPEC Record 5279409

TI: Intelligent handling of information; quality information systems help highlight improvement potential in the manufacturing process.
AB: Flexible organization and optimization of production and assembly processes are essential for the modern producer anxious to keep abreast of the competition. In order to maintain control over the situation and avoid the creation of new weak points, a quality information system capable of preparing and interpreting clearly arranged data relating to products and manufacturing processes represents an invaluable aid.

Engineers (N = 14)

 Manufacturing Processes 1.52	Arc Cutting -.66	Arcs (Electric) -.76	Arc Furnaces -.82
Joining Processes -.26	Adhesion -.69	Composite Material Interfaces -.39	Fibre Reinforced Composites -.58
Welding -.57	Welding Equipment -.64	Arc Welding -.76	Electron Beam Applications -.64
Lead Bonding -.76	Integrated Circuit Technology -.37	Beam-Lead Devices -.66	Hybrid Integrated Circuits -.62
Tape Automated Bonding -.53	Printed Circuit Manufacture -.12	Assembling .59	Clean Rooms -.65

Librarians (N = 14)

 Manufacturing Processes 1.29	Arc Cutting -.79	Arcs (Electric) -.66	Arc Furnaces -.82
Joining Processes -.60	Adhesion -.81	Composite Material Interfaces -.23	Fibre Reinforced Composites -.72
Welding -.92	Welding Equipment -.98	Arc Welding -.78	Electron Beam Applications -1.00
Lead Bonding -.84	Integrated Circuit Technology .05	Beam-Lead Devices -.92	Hybrid Integrated Circuits -.31
Tape Automated Bonding -.55	Printed Circuit Manufacture -.18	Assembling .52	Clean Rooms -.88

Figure 2: Relevance Assessments for INSPEC Record 00916781

TI: Future of physics with heavy ions

AB: If a heavy-ion 'space' is defined as bounded by the three axes of mass, energy and intensity, it becomes clear that there are large parts of this space which are completely unexplored. This, by itself, is an attractive situation since unexpected phenomena will almost certainly be found. However, the author believes that on the basis of what we already know about nuclei, atoms, and the solid state, there is ample justification to push the physics of these unexplored regions. The recent discovery that 'deep inelastic scattering' is a principal reaction mechanism between two heavy nuclei was largely unexpected and this experiment is briefly discussed. Several examples of interesting future measurements in nuclear and atomic physics with heavy-ions in the energy range of 100 MeV/AMU are discussed.

Engineers (N = 14)

Top Record Nuclear Physics 1.52	Fission Reactors -.03	Fission .01	Delayed Neutrons -.07
Nuclear Structure 1.14	Nuclear Reactions and Scattering 1.19	Collision Processes .37	Charge Exchange -.00
Nuclear Structure Theory 1.47	HF Calculations -.34	Atomic Structure .79	Ab Initio Calculations -.43
Nuclear Models 1.28	Nucleus .68	Atoms .80	Atomic Beams .02
Nuclear Collective Model .52	Nuclear Collective States and Giant Resonances .46	Isobaric Analogue Resonances -.57	Nuclear Shape .55

Librarians (N = 14)

Top Record Nuclear Physics 1.43	Fission Reactors -.19	Fission .11	Delayed Neutrons -.19
Nuclear Structure 1.17	Nuclear Reactions and Scattering 1.22	Collision Processes .12	Charge Exchange -.01
Nuclear Structure Theory 1.12	HF Calculations -.24	Atomic Structure 1.22	Ab Initio Calculations -.37
Nuclear Models .95	Nucleus 1.06	Atoms 1.07	Atomic Beams -.27
Nuclear Collective Model .30	Nuclear Collective States and Giant Resonances .15	Isobaric Analogue Resonances -.04	Nuclear Shape .67

Figure 3: Relevance Assessments for ERIC Record EJ516093 EC612539

TI: Suggestive Parallels between Kirton's A-I Theory of Creative Style and Koestler's Bisociative Theory of the Creative Act.
AB: This paper explores connections between Kirton's Adaption-Innovation Theory of cognitive style and Koestler's bisociative theory of the creative act. The three Kirton factor/traits (sufficiency of originality, efficiency, and rule/group conformity) are integrated into Koestler's conceptual framework of the creative act which stresses the creation of new combinations of elements from different domains.

Engineers (N = 14)

Top Record Theories .84	Generalization -.07	Association (Psychology) .56	Association Measures .16
Linguistic Theory .31	Anthropological Linguistics -.28	Cultural Context -.08	Aesthetic Values .20
Generative Grammar .11	Generative Phonology -.08	Phonemics -.11	Contrastive Linguistics .25
Transformational Generative Grammar -.06	Syntax -.25	Adjectives -.62	Adverbs -.66
Context Free Grammar -.14	Grammar -.17	Case (Grammar) -.26	Form Classes (Languages) .16

Librarians (N = 14)

Top Record Theories .86	Generalization -.23	Association (Psychology) .85	Association Measures .64
Linguistic Theory .58	Anthropological Linguistics .13	Cultural Context .41	Aesthetic Values .05
Generative Grammar -.24	Generative Phonology -.09	Phonemics -.21	Contrastive Linguistics .44
Transformational Generative Grammar -.35	Syntax .15	Adjectives -.45	Adverbs -.64
Context Free Grammar -.23	Grammar -.09	Case (Grammar) -.57	Form Classes (Languages) -.33

Figure 4: Relevance Assessments for ERIC Record EJ515482 TM519186

TI: The Logic of Educational Policy.
AB: Some arguments of E. Callan for the need for common education and the importance of early training are well-founded, but his conclusion that limited separate education may be advisable is not. This discussion on the logic of educational policy defends a common schooling to obtain a common education.

Engineers (N = 14)

 Logic .14	Logical Thinking .19	Abstract Reasoning -.20	Comprehension -.07
Mathematical Logic -.88	Computational Linguistics -1.05	Automatic Indexing -.87	Automation -1.06
Mathematical Formulas -.87	Computation -.56	Algorithms -.68	Mathematics -.27
Equations (Mathematics) -.75	Functions (Mathematics) -.69	Mathematical Concepts -.68	Conservation (Concept) -.55
Differential Equations -.98	Calculus -.79	Analytic Geometry -.88	Algebra -.74

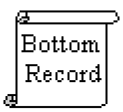
Librarians (N = 14)

 Logic -.05	Logical Thinking -.13	Abstract Reasoning -.23	Comprehension -.05
Mathematical Logic -.98	Computational Linguistics -.77	Automatic Indexing -1.04	Automation -.96
Mathematical Formulas -.93	Computation -.81	Algorithms -.79	Mathematics -.76
Equations (Mathematics) -.86	Functions (Mathematics) -.96	Mathematical Concepts -.72	Conservation (Concept) -.56
Differential Equations -.89	Calculus -.95	Analytic Geometry -.94	Algebra -.81

Figure 5: Relevance Assessments for INSPEC Record 5285612

TI: Recent and future technical trends of electrochemical microfabrication technology in Japanese electronics.
AB: Electrochemical microfabrication technology in the electronics technology field has recently made remarkable advances, particularly in the electronic components and materials field and peripheral technology fields. Electrochemical microfabrication technology is a technique that may be referred to as a basic foundation of electronics and is related in a complex way to the metallurgical, physical, chemical, mechanical, and biological fields as a basic electrochemical technology such as metal deposition, photoprinting/photofabrication, etching, and forming. In this paper, research and development in and the status of electrochemical microfabrication technology, composite element technology, and recent application examples in Japanese electronics in the electronic components and materials field are primarily explained.

Engineers (N = 14)

Manufacturing Processes 1.01	Arc Cutting -.46	Arcs (Electric) -.06	Arc Furnaces -.50
Joining Processes .57	Adhesion .07	Composite Material Interfaces .70	Fibre Reinforced Composites .02
Welding -.06	Welding Equipment -.44	Arc Welding -.46	Electron Beam Applications .46
Lead Bonding -.55	Integrated Circuit Technology 1.12	Beam-Lead Devices -.08	Hybrid Integrated Circuits .72
Tape Automated Bonding -.00 	Printed Circuit Manufacture 1.07	Assembling .05	Clean Rooms -.45

Librarians (N = 14)

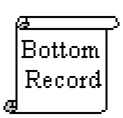
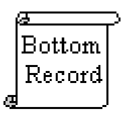
Manufacturing Processes .89	Arc Cutting -.48	Arcs (Electric) -.03	Arc Furnaces -.48
Joining Processes .36	Adhesion .01	Composite Material Interfaces .80	Fibre Reinforced Composites .21
Welding -.32	Welding Equipment -.38	Arc Welding -.31	Electron Beam Applications .21
Lead Bonding -.12	Integrated Circuit Technology .69	Beam-Lead Devices -.27	Hybrid Integrated Circuits .29
Tape Automated Bonding -.30 	Printed Circuit Manufacture .36	Assembling .04	Clean Rooms -.83

Figure 6: Relevance Assessments for INSPEC Record 5282573

TI: Disappearance of collective rotation in heavy ion collisions
AB: A theoretical analysis of collective rotation is performed in heavy ion collisions below 100 MeV/nucleon in the quantum molecular dynamics approach. Both methods contribute to this analysis, one is based on the shapes of the azimuthal distribution, and the other is based on the numerical semiclassical calculation of rotation. The collective rotation becomes weaker with increasing beam energy, and tends to fade out at a certain beam energy. The impact parameter dependence of collective motion is also discussed. In connection with recent experiments, theoretical results and experimental data are compared by taking into account the fluctuation of the experimental reaction plane determination.

Engineers (N = 14)

Nuclear Physics 1.15	Fission Reactors -.02	Fission .14	Delayed Neutrons -.27
Nuclear Structure .31	Nuclear Reactions and Scattering 1.04	Collision Processes 1.46	Charge Exchange -.24
Nuclear Structure Theory .50	HF Calculations .05	Atomic Structure .25	Ab Initio Calculations .04
Nuclear Models .85	Nucleus .10	Atoms .33	Atomic Beams .56
Nuclear Collective Model .82 	Nuclear Collective States and Giant Resonances .53	Isobaric Analogue Resonances -.30	Nuclear Shape .09

Librarians (N = 14)

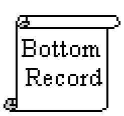
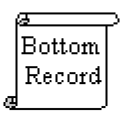
Nuclear Physics .92	Fission Reactors -.13	Fission -.05	Delayed Neutrons -.11
Nuclear Structure .52	Nuclear Reactions and Scattering .63	Collision Processes 1.34	Charge Exchange .35
Nuclear Structure Theory .90	HF Calculations .27	Atomic Structure .38	Ab Initio Calculations .26
Nuclear Models .52	Nucleus .27	Atoms .64	Atomic Beams .28
Nuclear Collective Model .81 	Nuclear Collective States and Giant Resonances .53	Isobaric Analogue Resonances -.38	Nuclear Shape .25

Figure 7: Relevance Assessments for ERIC Record ED207581 IR009699

TI: Parsing Protocols Using Problem Solving Grammars. AI Memo 385.
AB: A theory of the planning and debugging of computer programs is formalized as a context free grammar, which is used to reveal the constituent structure of problem solving episodes by parsing protocols in which programs are written, tested, and debugged. This is illustrated by the detailed analysis of an actual session with a beginning student working on a typical introductory LOGO project. The virtues and limitations of the context-free form of the grammar as a technique for summarizing certain insights into the structure of planning and debugging are discussed, and 17 references are listed.

Engineers (N = 14)

Theories .13	Generalization -.43	Association (Psychology) -.45	Association Measures -.35
Linguistic Theory -.29	Anthropological Linguistics -.69	Cultural Context -.45	Aesthetic Values -.71
Generative Grammar .36	Generative Phonology -.48	Phonemics -.51	Contrastive Linguistics -.11
Transformational Generative Grammar -.01	Syntax .47	Adjectives -1.00	Adverbs -1.00
Context Free Grammar 1.00 	Grammar .33	Case (Grammar) .10	Form Classes (Languages) .21

Librarians (N = 14)

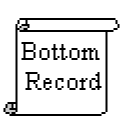
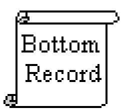
Theories .63	Generalization -.08	Association (Psychology) -.26	Association Measures .03
Linguistic Theory .55	Anthropological Linguistics -.36	Cultural Context -.53	Aesthetic Values -.69
Generative Grammar .63	Generative Phonology -.09	Phonemics -.06	Contrastive Linguistics .04
Transformational Generative Grammar .62	Syntax .75	Adjectives -.28	Adverbs -.57
Context Free Grammar 1.84 	Grammar .98	Case (Grammar) .09	Form Classes (Languages) .42

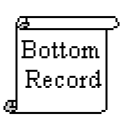
Figure 8: Relevance Assessments for ERIC Record EJ449288 SE549931

TI: A Second-Year Undergraduate Course in Applied Differential Equations.
AB: Presents the framework for a chemical engineering course using ordinary differential equations to solve problems with the underlying strategy of concisely discussing the theory behind each solution technique without extensions to formal proofs. Includes typical class illustrations, student responses to this strategy, and reaction of the instructor.

Engineers (N = 14)

Logic .00	Logical Thinking .35	Abstract Reasoning -.22	Comprehension -.16
Mathematical Logic .48	Computational Linguistics -.53	Automatic Indexing -1.24	Automation -.91
Mathematical Formulas .68	Computation .39	Algorithms .24	Mathematics 1.15
Equations (Mathematics) .89	Functions (Mathematics) .47	Mathematical Concepts 1.03	Conservation (Concept) -.26
Differential Equations 2.14 	Calculus 1.48	Analytic Geometry -.30	Algebra -.15

Librarians (N = 14)

Logic .54	Logical Thinking .75	Abstract Reasoning .40	Comprehension .29
Mathematical Logic .89	Computational Linguistics -.26	Automatic Indexing -1.11	Automation -.70
Mathematical Formulas .87	Computation .30	Algorithms .42	Mathematics .90
Equations (Mathematics) .95	Functions (Mathematics) .60	Mathematical Concepts .97	Conservation (Concept) -.50
Differential Equations 1.66 	Calculus .70	Analytic Geometry -.15	Algebra .05