"THE SELECTION OF AUTHORITY IN LEGAL ARGUMENT: SEMANTIC SIMILARITY, PRAGMATIC CENTRALITY AND ANALOGY"

by

Katherine KRAWCZYK*
Garry MARCHANT**
John ROBINSON***

93/39/AC

* Assistant Professor of Accounting, at North Carolina State University, U.S.A.

** Associate Professor of Accounting and Control, at INSEAD, Boulevard de Constance, Fontainebleau 77305 Cedex, France.

*** Associate Professor of Accounting, at University of Texas at Austin, U.S.A.

Printed at INSEAD, Fontainebleau, France

THE SELECTION OF AUTHORITY IN LEGAL ARGUMENT: SEMANTIC SIMILARITY, PRAGMATIC CENTRALITY AND ANALOGY

Katherine Krawczyk

North Carolina State University

Garry Marchant

INSEAD

and

John Robinson

University of Texas at Austin

March 1993

Address correspondence to John R. Robinson, Department of Accounting, 4M.202 CBA, University of Texas at Austin, Austin, TX 78712-1172.

THE SELECTION OF AUTHORITY IN LEGAL ARGUMENT: SEMANTIC SIMILARITY, PRAGMATIC CENTRALITY AND ANALOGY

ABSTRACT

The impact of constraint satisfaction on the selection of authorities in legal reasoning was examined in three experiments. It was hypothesized that subjects would select authorities with semantic similarities over authorities that are structurally consistent with a problem. In the first experiment 23 tax professionals from a large multinational public accounting firm were asked to rank the appropriateness of four tax authorities for each of ten problems. In the second experiment 38 tax professionals were asked to rate on a 9-point scale the appropriateness of two authorities, presented separately, for each of eight problems. The authorities in both experiments varied in their level of structural consistency and semantic similarity in relation to the original problem, and in both experiments subjects rated authorities with high semantic similarity as more appropriate than authorities with high structural consistency. In the third experiment 83 tax professionals were asked to rate on a 9-point scale the appropriateness of two different authorities for each of four problems. To introduce pragmatic considerations, each authority varied by whether the outcome was favorable or unfavorable to the client. The results supported those of the first two experiments in that the subjects selected authorities with high semantic similarity over authorities with high structural consistency. This occurs even when the authority with high structural consistency results in an outcome favorable to the client. On the other hand, subjects select authorities with high semantic similarity and an outcome favorable to the client over authorities that result in unfavorable outcomes, indicating that pragmatic centrality moderates the impact of semantic similarity in the selection stage. Consistent with the theory, semantic similarity was the dominant constraint and structural consistency had a negligible impact on selection of an authority.

THE SELECTION OF AUTHORITY IN LEGAL ARGUMENT: SEMANTIC SIMILARITY, PRAGMATIC CENTRALITY AND ANALOGY

Legal reasoning involves the justification of a legal position by the construction of a legal argument. Legal arguments are constructed most frequently by generating an analogy based on a previously decided case. This dependence on analogy in American law is a result of the inability of advocates to solve legal problems by deduction from a general rule. While the legal domain does contain many general rules, these rules do not have well-defined predicates, and therefore, it is difficult for the advocate to determine how the general rule applies to a specific situation (Ashley, 1988a). As a result, advocates argue analogically using previously decided cases in which a court applied the general rule.

Analogical reasoning can be decomposed into four stages; (1) selection of a plausible source analog, (2) mapping between the selected source and the problem, (3) transfer of information to problem for solution, and (4) learning for future application. Holyoak and Thagard (1989) and Thagard, Holyoak, Nelson & Gochfeld (1990) argue that three major constraints govern the analogical process. These three constraints are semantic similarity, structural consistency and pragmatic centrality. The analogical reasoning process is governed by the satisfaction of these constraints which limit the consideration of potential correspondences between the problem and the source analog.

Semantic similarity represents the influence of the shared features of the source analog and the problem. Structural consistency restricts analogies to situations where relations correspond. Pragmatic centrality represents information on the purpose for which the analogy is being constructed. Marchant, Robinson, Anderson and Schadewald (in press) in a study of the construction of legal argument examined the interaction of these

three constraints in the mapping stage. They found, consistent with Holyoak and Thagard (1989), that structural consistency is the dominant constraint in the mapping stage, but that pragmatic centrality interacts with structural consistency such that a legal argument that supports the desired outcome is constructed.

This paper examines the simultaneous satisfaction of these constraints in the selection of an authority (a plausibly useful previously decided case) for use in constructing a legal argument. The selection of a legal authority which provides the strongest possible support for the argument being constructed is critical. An authority which can be undermined or distinguished severely reduces the strength of a legal argument. The constraints act within the selection process to ensure that only the most promising of the potential authorities will be selected for input to the mapping process.

SELECTING LEGAL AUTHORITY

As described by Marchant, Robinson, Anderson and Schadewald (in press), the construction of a legal argument by an advocate on behalf of a client requires the identification of a legal authority for use as a precedent. The case to be selected should have characteristics similar to the problem situation and should result in an outcome favorable to the client. Differences in the characteristics between the problem and potential precedent may be important because these characteristics may provide a basis for an opponent to use other, similar cases with unfavorable outcomes as counter-examples. Thus, both the similarities and differences between the characteristics of a decided case and the problem situation are critical to the construction of a persuasive legal argument (Ashley, 1988b).

In conducting a search for a precedent, advocates must search for the decided case which provides the most persuasive legal argument, given the similarities and differences

between the decided case and the problem. Since legal authorities are voluminous and most legal problems are complex, the search for appropriate precedent may be quite time consuming. Thus, the identification of the similarities and differences may also be vital to the efficiency of the search.

Thagard, Holyoak, Nelson and Gochfeld (1990) describe a model for selecting source analogs that is designed so that only the most promising potential sources are selected for input into analogical mapping. They posit that three constraints govern this process of selecting a source analog: semantic similarity, structural consistency, and pragmatic centrality. In the legal context, semantic similarity refers to the correspondence between the factual characteristics of the client's problem and the factual characteristics of the potential precedent (case). Structural consistency concerns whether the relations in the problem and the precedent are isomorphic. Finally, in the legal context, pragmatic centrality refers to the purpose of legal reasoning which is to generate the strongest argument possible in support of the client's favored position.

Many different authorities would be examined simultaneously in the search for a potentially relevant precedent, and these three constraints act simultaneously to determine which potentially useful precedent is selected. The constraints operate to limit the selection of analogs with lesser relevance through a competitive search process. The semantic constraint is the most crucial of the three because some degree of similarity is necessary in order to initiate a probe of the potential analogs. The other two constraints will play a lesser role in this selection phase, but become more important in the latter phase of analog mapping and transfer (Thagard, Holyoak, Nelson and Gochfeld, 1990). The purpose of the following experiments is to examine how these three constraints interact within the selection process in determining which potentially useful case is selected as precedent.

EXPERIMENT 1

This experiment was designed to test the relative impact of semantic similarity and structural consistency on subjects' choice of authorities in a tax situation. Pragmatic centrality was controlled so as not to have an impact on the selection of authorities in this experiment. The experiment was conducted using tax professionals as subjects, each of whom received ten short problems. Each problem was followed by four brief synopses of hypothetical tax authorities.

Method

Subjects

There were 23 tax professionals who participated in the experiment. The tax professionals came from one office of a international public accounting firm, and had from 2 to 23 years of tax experience (the median tax experience for the group was 4.25 years).

Experimental Design

Two variables were manipulated in this experiment: semantic similarity and structural consistency. Both variables were within-subjects. For each of the ten problems used in the experiment four authorities were presented to participants. The authorities varied in their level of semantic similarity to the problem (high and low) and level of structural consistency (high and low). Thus, as described in panel A of Table 1, there were four categories for the authorities:

On Point: high in both structural consistency and semantic similarity.

High Structure:	high in structural consistency and low in semantic similarity.
High Semantic:	low in structural consistency and high in semantic similarity.
No Relevance:	low in both structural consistency and semantic similarity.

High semantic similarity was operationalized by including in the potential analog many of the same facts as found in the problem, whereas for low semantic similarity the analog involved few of the same facts. High structural consistency was operationalized by basing the potential analog on the same primary tax principle or concept implicit in the problem. In most cases, structural consistency was at a more abstract level than is found in any one specific section of the Internal Revenue Code. Authorities with low structural consistency did not share the primary tax principle or concept with the problem.

Procedures and Materials

The ten problems presented to participants dealt with issues from several different tax areas. Variety was added for two purposes. First, by including several areas of tax law, the effect of any specialized tax knowledge that some of the subjects may have acquired can be reduced or eliminated.[1] Second, variety was needed to ensure that the results were consistent across problems, and were not due to the uniqueness of the issue under consideration.

One authority from each of the four categories was included for each problem. To increase the experiment's external validity, each hypothetical authority was based on actual tax cases and rulings. All of the authorities were approximately two sentences long, describing only the major facts and points of law applied. These short synopses of cases are consistent with the type of information available through various tax research aids (such

as *CCH Federal Tax Reports*).[2] An example of one problem with four authorities is presented in Exhibit 1.

EXHIBIT 1

Two additional factors were considered in designing the authorities used in the experiment. To eliminate the effect of the level of authority (e.g. court of appeal, Tax Court, etc.) may have in the actual decision process, the authorities were written without any designation of origination. Further, the authorities were also designed to be favorable to the client in all situations. Two randomly determined orders of each set of four authorities were combined with two randomly determined orders of the ten problems to result in four separate test instruments.[3]

The subjects were told to consider each problem and the four tax authorities that followed each problem. They were asked to rank the appropriateness of the four authorities in addressing the main issue of the problem, from 1 as most appropriate to 4 as least appropriate. Additionally, the subjects were asked to identify the main issue in each problem to provide a check that they understood the issue at hand.[4] An example of one of the problems used is attached as Exhibit 1. The subjects were to complete each problem before going on to the next one, and were instructed not to change their answers. The subjects were not required to draw a conclusion, or reach a decision as to the proper tax treatment. The dependent variable is the ranking of each category of authority, which was calculated for each subject.

Results

Subjects were expected to rank the On Point and No Relevance authorities as 1 and 4, respectively. Subjects were expected to consider authorities with high semantic similarity as more appropriate precedent than authorities with high structural consistency. In Table 1, Panel A presents the experimental design, Panel B presents the expected ranking of the four authorities, and Panel C presents the mean rank and standard deviation for all ten problems combined.

TABLE 1

To test the significance of differences in overall means for all subjects, both the sign test and the Wilcoxon matched-pairs, signed rank tests were conducted on the High Structure and High Semantic means. These tests show that the mean for the High Structure authorities is significantly higher than the High Semantic authorities mean (Sign Test - $Z=6.06$, $p<.001$ and Wilcoxon Matched-pair Test $Z=5.72$, $p<.001$) indicating that the subjects rate the High Semantic authorities as more appropriate than the High Structure authorities. Tests using Kendall's Coefficient of Concordance, presented in Table 2, indicate that the rankings of the subjects were consistent across the ten problems for all four types of authorities.

TABLE 2

Discussion

The results indicate that tax professionals appear to consider tax authorities with high semantic similarity as more appropriate than those with high structural consistency. This result applies to the stage in tax research where tax authorities are considered and selected for later application to problem situations. An alternative explanation for these results might be that subjects, having identified the On Point authority as a perfect match, might not expend much effort on ranking the other authorities. A second experiment was conducted to examine this alternative.

EXPERIMENT 2

This experiment was designed to test the relative impact of structural consistency and semantic similarity on the appropriateness of tax authorities without providing an On Point authority. Subjects were given eight short problems (drawn from the ten problems used in Experiment 1). Each problem was separately matched with the High Structure authority and the High Semantic authority leading to sixteen problem-authority pairs. For each problem-authority pair, subjects were asked to rate on a continuous scale the appropriateness of the authority in resolving the issue in the problem.

Method

Subjects

The participants in this second experiment consisted of 38 experienced tax professionals. These professionals work for a international public accounting firm and

completed the materials at a training session scheduled by the firm. The professionals had from two to ten years experience with a median for the group of 3.5 years.

Experimental Design

The independent variable in the second experiment, Constraint, was a within-subjects variable with two levels. When Constraint was set to semantic, semantic similarity was high and structural consistency was low (described hereafter as "Semantic"). When Constraint was set to structure, semantic similarity was low and structural consistency was high (described hereafter as "Structure"). In this way, the interplay between the two types of constraints was examined. An example of one of the problems and the associated authorities is attached as Exhibit 2.

EXHIBIT 2

Procedures and Materials

Eight of the ten problems presented to participants in the first experiment were used in this experiment. Two problems were dropped because of the variance in responses given to those problems in Experiment 1. One authority from each of the two categories was included separately with each problem. Thus, each problem appeared twice, once with each of the two categories of authority. The authorities were the same as those used in Experiment 1 for each of these categories. Two randomly determined orders of the eight problems were generated resulting in two different test booklets.

The subjects were told to consider each client problem and the tax authority that followed each problem. They were asked to rate the appropriateness of the authority in answering the main issue in the problem on a nine point scale with end points ranging from

Very Appropriate to Very Inappropriate. Additionally, the subjects were asked to identify the main issue in each problem. The subjects were to complete each problem before going on to the next one, and were told not to change any answers. The dependent variable was the rating of each type of authority. The data were analyzed in a 2 x 8 ANOVA with Constraint and Problem being the independent variables. Years of experience and case order were included as covariates.

Results and Discussion

Subjects were expected to rate authorities with high semantic similarity as more appropriate than authorities with high structural consistency. The ANOVA that tests for this interaction is presented in Panel A, Table 3. The mean and standard error for Constraint across problems is shown in Panel B of Table 3.

TABLE 3

The main effect for Constraint was significant ($F=4.74$, $p=.038$). As the means presented in Panel B, Table 3 indicate, the subjects rated the Semantic authority as more appropriate than the Structure authority. As presented in Table 4, this rating was consistent across all eight problems.

TABLE 4

The results of this experiment confirm the results of Experiment 1. The subjects selected authorities with high semantic similarity over authorities with high structural

consistency.[5] In both experiments, the authorities were designed to produce outcomes that would be favorable to a client. The purpose was to control pragmatic centrality. The following experiment examines whether pragmatic centrality moderates the influence of semantic similarity on the selection of tax authorities.

EXPERIMENT 3

This experiment was designed to test the effect of structural consistency and semantic similarity on the appropriateness of tax authorities when the outcome varied between authorities. The goal of client advocacy allows professionals to distinguish tax authorities that support contrary conclusions by discovering issue dissimilarities. These pragmatic considerations may also induce tax professionals to engage in analogical reasoning and consider authorities in similar situations that are favorable (Marchant, Robinson, Anderson, and Schadewald, in press).

One factor that can influence the success of analogical reasoning is pragmatic centrality which emphasizes the purpose for which the analogy is being constructed based on either explicit or implicit knowledge (Thagard, Holyoak, Nelson and Gochfeld, 1990). Pragmatic centrality is not expected to dominate semantic similarity in the selection of authorities. That is, the authority with high semantic similarity should still be most likely to be selected as precedent. However, when authorities with high semantic similarity have unfavorable outcomes and authorities with high structural consistency result in favorable outcomes, then pragmatic centrality may moderate the influence of semantic similarity.

Method

Subjects

The subjects for this experiment were 83 tax professionals from one Big 6 public accounting firm. Two groups of subjects completed the experimental materials at separate meetings of a firm-wide training session. The professionals had from one to eight years of experience with a median level for the group of 3.25 years.

Experimental Design

This experiment used two fully crossed independent variables: Constraint and Outcome. Constraint was the same within-subjects variable as used in the previous experiment. The two levels of Constraint were High Semantic authorities and High Structure authorities. The second independent variable, Outcome, was the outcome of the authority. Two types of decisions were used. One type of decision resulted in an authority that was favorable to the taxpayer (e.g. the authority provided for a deferral or exclusion of income). The second decision type presented an authority that was considered unfavorable because it provided for immediate recognition of income.

Procedures and Materials

Four of the Experiment 2 problems were presented to the subjects in this experiment. The problems were chosen to minimize the wording changes necessary to change the decision. One authority from each of the two categories was included separately with each problem, resulting in eight problem-authority pairs. A Latin Square design was used where four test booklets were generated to fully balance the four problems with the four combinations of the independent variables. Each booklet contained eight problem-

authority pairs. One of the four problems had both favorable Semantic and Structure authorities, in another problem both authorities were unfavorable, and in the final two problems one authority was favorable and the other was unfavorable (the reverse of each other). These combinations of the independent variables of Outcome type and Constraint type are referred to as the Authority Combination in the later analysis.

The subjects were again asked to consider the problem and authority, and rate the authority as to its appropriateness in answering the main issue of the problem. They were also asked to identify the main issue in the problem. The dependent variable was the difference in ratings calculated by subtracting the rating for Structure authorities from the rating for Semantic authorities. The differences in ratings were analyzed in a 4 x 4 x 4 Latin Square, with case, booklet, and authority combination as the independent variables.

Results and Discussion

Subjects are expected to consider authorities with high semantic similarity as more appropriate than authorities with high structural consistency. However, this result will be moderated when the semantic authority has unfavorable consequences for a taxpayer and the structure authority results in a favorable conclusion. In other words, the difference between the ratings should be smallest for the Semantic, Unfavorable/ Structure, Favorable combination. The Latin Square ANOVA that tests this hypothesis is presented in Panel A of Table 5, while the means and standard errors for each case and combination are shown in Panel B.

TABLE 5

The main effect for authority combination was marginally significant (F=2.28, p=.09). The means in Panel B indicate that in almost all instances, subjects rated the Semantic authority as more appropriate than the Structure authority. A pairwise test of means indicates that the difference in ratings for the Structure Favorable/ Semantic Unfavorable combination is significantly less than the difference for the Structure Unfavorable/ Semantic Favorable combination (t=2.478, p=.016). Examining the individual case means for each rating type (see Panels A and B of Table 6) suggests that this result is due to significantly lower Semantic similarity ratings for the former authority combination.

TABLE 6

The results from experiment 3 indicate that the subjects appear to value authorities with high semantic similarity more than authorities that have high structural consistency. This result occurs even when the authority with high structural consistency results in an outcome favorable to the client. On the other hand, the subjects selected authorities with high semantic similarity and an outcome favorable to the client over authorities that resulted in unfavorable outcomes.

GENERAL DISCUSSION

The experiments confirm that subjects select tax authorities with high semantic similarity over authorities with high structural consistency. While this result was moderated by pragmatic centrality, overall the judgments of the subjects were not swayed by pragmatic considerations. This is consistent with the theory that semantic similarity is the dominant constraint in the selection stage of legal reasoning. Thagard, Holyoak,

Nelson, and Gochfeld (1990) predict that different constraints will dominate different stages of analogical reasoning. Their predictions are reproduced in Panel A of Table 7.

TABLE 7

Marchant, Robinson, Anderson and Schadewald (1991) investigated the effect of constraints on the next stage of legal reasoning, mapping. They found that, in contrast to the results of the experiments in this study, structural consistency was the dominant constraint. Their results also indicated that pragmatic centrality moderated the influence of structural consistency. These results and the results of the experiments described in this manuscript are presented in Panel B of Table 7.

These results provide a more finely tuned representation of the constraint satisfaction process than the predictions of Thagard, Holyoak, Nelson, and Gochfeld (1990). In the selection stage, semantic similarity is the dominant constraint and structural consistency has a negligible influence. In the mapping stage, structural consistency is the dominant constraint and semantic similarity has a negligible influence. In both stages, pragmatic centrality increasingly moderates the influence of the dominant constraint.

Neither of these experimental studies address the transfer and learning stages of legal reasoning. In both of these stages, pragmatic centrality would be expected to be the dominant constraint. In other words, in legal reasoning the advocate would only be expected to use authorities which provide a favorable result for the client. Semantic similarity and structural consistency would still be expected to be important because differences between the precedent and the problem could provide opponents to attack the use of the precedent. Because of the possibility of opposition to the precedent, the selection and use of authorities also depends upon the advocate's ability to model an

opponent's choice of precedent (Thagard, 1992). Thus, the selection and use of authorities in the construction of a legal argument is only one part of a rich and complex adversarial problem solving process.

REFERENCES

Ashley, K. D. (1988a). Arguing by analogy in law: A case-based model. In D. Helman (Ed.), *Analogical reasoning: Perspectives of artificial intelligence, cognitive science and philosophy* (205-224). Dordrecht, The Netherlands: Kluwer.

Ashley, K. D. (1988b). *Modelling legal argument: Reasoning with cases and hypotheticals.* Unpublished Phd dissertation, University of Massachusetts.

Holyoak, K. & Thagard, P. (1989). Analogical mapping by constraint satisfaction. *Cognitive Science*, **13**, 295-355.

Marchant, G., Robinson, J., Anderson, U., & Schadewald, M. (1991). Analogical transfer and expertise in legal reasoning. *Organizational Behavior and Human Decision Processes*, **48**, 272-290.

Marchant, G., Robinson, J., Anderson, U., & Schadewald, M. (in press). The use of analogy in legal argument: Problem similarity, precedent and expertise. *Organizational Behavior and Human Decision Processes.*

Thagard, P. (1992). Adversarial problem solving: Modeling an opponent using explanatory coherence. *Cognitive Science*, **16**, 123-149.

Thagard, P., Holyoak, K. J., Nelson, G. & Gochfeld, D. (1990). Analog retrieval by constraint satisfaction. *Artificial Intelligence*, **46**, 259-310.

TABLE 1

Experiment 1: Experimental Design, Hypotheses, and Results

Panel A: Experimental Design

Semantic Similarity	Structural Consistency: High	Structural Consistency: Low
High	On Point	High Semantic
Low	High Structure	No Relevance

Panel B: Hypothesized Ranking Of Authorities

Semantic Similarity	Structural Consistency: High	Structural Consistency: Low
High	1	2
Low	3	4

Panel C: Means (Standard deviations) of Rankings by Variable

Semantic Similarity	Structural Consistency: High	Structural Consistency: Low
High	1.13 (0.12)	2.32 (0.21)
Low	2.82 (0.17)	3.73 (0.21)

TABLE 2

Experiment 1: A Test for Agreement of Rankings Across Problems--The Kendall Coefficient of Concordance

Structural Consistency	Semantic Similarity	Cell	Chi-Square	P
High	High	On Point	21.654	0.010
High	Low	High Structure	39.971	0.000
Low	High	High Semantic	29.718	0.000
Low	Low	No Relevance	31.226	0.000

TABLE 3

Experiment 2: The Effect of Constraint on the Rating of the Appropriateness of Tax Authorities

Panel A: Analysis of subjects' appropriateness rating across all eight problems

	Df	SS	F Value	P
Constraint	1	36.99	4.74	.038
Problems	7	144.91	3.97	.001
Constraint X Problems	7	61.04	1.98	.060
Experience	1	75.21	9.54	.004
Case Order	1	9.48	1.20	.282

Panel B: Means (standard errors) of subject's appropriateness rating

Constraint	
Structure	Semantic
3.842	5.420
(.166)	(.167)

TABLE 4

Experiment 2: The Mean Rating of Both Types of Authority for Each Problem

Problem	Structure	Semantic
1	1.785	2.861
2	3.294	3.673
3	2.376	5.342
4	6.427	6.464
5	4.755	7.106
6	3.794	4.752
7	3.679	6.942
8	4.627	6.221

TABLE 5

Experiment 3: The Effect of Constraint and Pragmatic Centrality on the Rating of Appropriateness of Tax Authorities

Panel A: Analysis of the Difference in Ratings Across all Eight Problem-Authority Pairs

	Df	SS	F Value	P
Booklet	3	26.60	0.73	ns
Subject within Booklet	79	962.52		
Case	3	243.59	8.74	.001
Authority Combination	3	63.45	2.28	.09
Residual	6	36.38	0.65	ns
Subject by Case	228	2118.01		
Total	322	3450.55		

Panel B: Means (standard errors) of Difference Ratings

Structure	Semantic	Case 1	Case 2	Case 3	Case 4
favorable	favorable	3.59 (2.59)	1.64 (2.56)	-0.74 (3.29)	1.52 (3.68)
unfavorable	favorable	3.03 (4.10)	2.07 (2.97)	1.01 (1.93)	1.96 (2.55)
favorable	unfavorable	1.66 (3.12)	1.40 (2.83)	-0.38 (3.79)	0.85 (3.55)
unfavorable	unfavorable	2.34 (1.75)	1.64 (3.11)	0.79 (3.99)	2.53 (3.53)

TABLE 6

Experiment 3: The Effect of Constraint and Pragmatic Centrality on the Rating of Appropriateness of Tax Authorities

Panel A: Means (standard errors) of Semantic Ratings

Structure	Semantic	Case 1	Case 2	Case 3	Case 4
favorable	favorable	6.89 (1.20)	2.46 (2.23)	4.18 (2.30)	4.32 (2.48)
unfavorable	favorable	5.58 (2.60)	3.52 (2.63)	4.13 (2.28)	3.94 (1.89)
favorable	unfavorable	3.86 (2.34)	3.08 (2.55)	3.28 (2.54)	2.85 (2.46)
unfavorable	unfavorable	4.23 (2.26)	2.87 (2.58)	4.59 (2.46)	4.54 (2.15)

Panel B: Means (standard errors) of Structure Ratings

Structure	Semantic	Case 1	Case 2	Case 3	Case 4
favorable	favorable	3.29 (2.19)	0.82 (1.20)	5.09 (2.58)	2.80 (2.36)
unfavorable	favorable	2.55 (2.38)	1.44 (1.81)	3.30 (2.27)	1.98 (2.04)
favorable	unfavorable	2.09 (2.13)	1.64 (2.07)	3.66 (2.71)	2.00 (2.23)
unfavorable	unfavorable	1.83 (1.97)	1.23 (1.64)	3.79 (2.70)	2.00 (1.92)

TABLE 7

Relative Importance of Different Constraints

Panel A: Hypothesized Importance of different constraints at each stage of analogical thinking[1]

	Semantic Similarity	Structural Consistency	Pragmatic Centrality
Selection	Very	Yes	Yes
Mapping	Yes	Very	Yes
Transfer	Yes	Yes	Very

Panel B: Empirical Importance

Stage	Semantic Similarity	Structural Consistency	Pragmatic Centrality
Selection	Very	Less	Yes
Mapping	Less	Very	Yes
Transfer	Unknown	Unknown	Unknown

[1] The terms used to denote importance of different constraints in Panel A are those used by Thagard, Holyoak, Nelson and Gochfeld (1990, p.306). Here, Yes means that the constraint is important, and Very means that the constraint is very important. In panel B, these terms are used consistently, while Less indicates that the evidence suggests that the constraint has negligible importance.

EXHIBIT 1

Experiment 1: Example of Problem with the Four Authorities

Shelby Summerville sued the Herriston Herald for libel when the paper mistakenly printed that Shelby was a child abuser. Shelby received $10,000 in damages when the suit was settled.

Authorities:

A: Payments made by a county government to a police officer injured in the line of duty were excludable from the recipients gross income as workmen's compensation for personal injury.

B: Salary payments made by the federal government to an officer in the armed services were not includable in the recipient's gross income as compensation.

C: Damages awarded to a doctor for libel, where the libel was purely to the doctor's personal reputation, are for personal injury and the recovery is tax-free.

D: Damages awarded to a doctor for libel, where the libel was purely to the doctor's professional reputation, are for business injury. However, the recovery is not taxable since it was considered a return of goodwill to the doctor.

Ranking: (1 is most appropriate to answering the main issue of the case, 4 is least appropriate) PLEASE RANK ALL FOUR AUTHORITIES.

1.____ 2.____ 3.____ 4.____
Most Appropriate Least Appropriate

What is the major issue in the above case?

_____

EXHIBIT 2

Experiment 2: Problem with two levels of Constraint

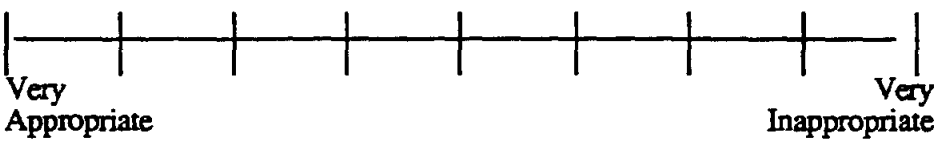
HIGH SEMANTIC, LOW STRUCTURE AUTHORITY WITH PROBLEM 9

Shelby Summerville, an electrical engineer, sued the Herriston Herald for libel when the paper mistakenly printed that Shelby was a child abuser. Shelby received $10,000 in damages when the suit was settled.

Authority:

Damages awarded to a doctor for libel, where the libel was purely to the doctor's professional reputation, are for business injury. However, the recovery is not taxable since it was considered a return of goodwill to the doctor.

Rating:



What is the major issue in the above case?

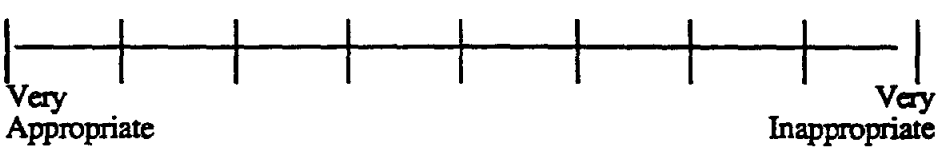
LOW SEMANTIC, HIGH STRUCTURE AUTHORITY WITH PROBLEM 12

Shelby Summerville, an electrical engineer, sued the Herriston Herald for libel when the paper mistakenly printed that Shelby was a child abuser. Shelby received $10,000 in damages when the suit was settled.

Authority:

Payments made by a county government to an employee injured in a skiing accident were excludable from the recipient's gross income as compensation for personal injury.

Rating:



What is the major issue in the above case?

FOOTNOTES

[6] This factor was further reduced by using only general areas of tax law that all professionals and students should have knowledge of (for example, office-in-home deductions, tax-free incorporations, etc.).

[2] During the initial stages of the tax research process, the above research aids are used extensively to provide help in locating authorities to consider applying to a problem.

[3] The effect of ordering is not significant, so all four groups of data were collapsed into one to conduct the remaining tests.

[4] Subjects did not rank all four authorities in 5 problems. The treatment means did not change significantly when these cases were eliminated, or when a case was eliminated due to the identification of an incorrect or missing issue. Therefore, the statistical tests were conducted using all cases.

[5] In the first two experiments, subjects did not have to choose between competing authorities. An additional experiment was designed to directly test the effect of structural consistency and semantic similarity on subject's choice of authorities when subjects are allowed to choose between the two types of authorities. The eight problems from experiment 2 were given to 40 tax professionals, and each problem was followed by two hypothetical authorities (High Semantic and High Structure). Subjects were asked to select the authority they would most rely on for analyzing the problem. The results (not reported) confirm those of the first two experiments. Six of the eight cases had a significant effect for the type of authority selected, and the large majority of subjects in these problems selected the High Semantic authority instead of the High Structure authority.