SHYSTER and the Authorization of Copyright Infringement

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Abstract

The SHYSTER project is concerned with the development of a hybrid legal expert system: one which uses rule-based techniques to represent statute law and case-based techniques to represent case law. A prototype has been developed, implementing the case-based part of SHYSTER. This prototype allows a legal expert to specify an area of case law using a specially-developed case law specification language.

The model of legal reasoning which has been adopted for the development of SHYSTER is explained, and the operation of the prototype is illustrated by example. An area of case law (the meaning of "authorization" in the *Copyright Act*) is specified, and SHYSTER is made to generate opinions about real cases on the basis of that specification. SHYSTER's legal opinions are compared with the actual judgments in those cases.

SHYSTER's case-based system performs well in two quite different legal domains, suggesting that SHYSTER's approach to case law may prove successful in other areas of law. Avenues of future research are identified, and the manner in which SHYSTER's case-based system will be linked with a rule-based system to form a hybrid legal expert system is explained.

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1 Introduction

The law in so-called "common law countries"—e.g. Australia, Britain, Canada, USA—is derived from legislation (statute law) and previously-decided cases (the common law). Until recently, legal expert systems (LESs) utilized exclusively rule-based techniques to represent both statute law and case law. But this approach has many shortcomings, and is fundamentally inadequate given the requirements of lawyers and the nature of legal reasoning about cases.[1]

In the mid-1980s, some systems were developed which make use of case-based techniques to deal with areas of case law.[2] In the late 1980s, several hybrid LESs were developed. These systems use a rule-based system to represent the law as embodied in legislation, and a case-based system to represent the law as embodied in cases.[3]

The SHYSTER project is concerned with the development of a hybrid LES. A prototype of SHYSTER has been developed, implementing the case-based part of the hybrid LES.

2 A model of legal reasoning

The development of a legal expert system requires a model of legal reasoning because, as Susskind (1987) points out:

> It is beyond argument ... that all expert systems must conform to some jurisprudential theory because all expert systems in law necessarily make assumptions about the nature of law and legal reasoning.[4]

The following model of the process of reasoning with statutes and case law has been adopted for the development of SHYSTER.

A lawyer examines the facts of the case in question (the *instant case*), and determines which statutes, if any, apply. These statutes are applied to the facts of the instant case.

Some of the concepts expressed in statutes are *open-textured*:[5] i.e. they are not fully defined. When a lawyer encounters one of these open-textured concepts, she/he looks to previously-decided cases in search of judicial argument, and pronouncements, as to the meaning of that open-textured concept.

Of course, some of the concepts in previously-decided cases could also be considered open-textured; it is possible to classify *all* concepts as open-textured,

[1] As explained by Popple 1990a, 1990b, 1991a.

[2] For example, Ashley's HYPO system (1989, 1990).

[3] For example, CABARET (Rissland and Skalak 1989a, 1989b) and PROLEXS (Oskamp 1989; Oskamp, Walker, Schrickx and van den Berg 1989; Walker, Zeinstra and van den Berg 1989).

[4] Susskind 1987, p. 20, emphasis omitted.

[5] The term *open texture* was first used in jurisprudence by Hart (1961).

but such an approach renders the term useless. Any model of legal reasoning that allows the existence of open-textured concepts requires an arbitrary level of abstraction, below which a concept must be considered to be fully defined. This model of legal reasoning allows that some concepts may be open-textured, but assumes that these concepts are amenable to full definition by reference to case law.

The meaning of an open-textured concept in a statute may determine the result of the application of that statute to the instant case. A lawyer argues about the meaning of an open-textured concept by reference to the facts of the instant case and those of previously-decided cases.

The results of some cases are *desirable* in that they ascribe a meaning to an open-textured concept which, when the statute is applied, leads to a desired result in the instant case. No two cases can be completely identical, given the plethora of facts associated with any given case. Some of these differences may be insignificant, and much of a lawyer's reasoning by analogy concerns the *legal* significance of these differences.

A lawyer reasons with cases by arguing that there are no legally significant differences between the instant case and previously-decided cases whose results are desirable, and/or that there are legally significant differences between the instant case and previously-decided cases whose results are not desirable.

3 SHYSTER

The operation of the prototype case-based part of SHYSTER is illustrated by example in §4. The open-textured concept of "authorization" in the *Copyright Act* is specified as an area of case law using SHYSTER's generalized case law specification language. SHYSTER interrogates the user as to the facts in the instant case, and gives advice as to whether those facts amount to an authorization of copyright infringement. That advice is evaluated in §5.

The mechanism by which a rule-base will be linked to SHYSTER's case-based system is explained in §6.

3.1 SHYSTER and judicial discretion

SHYSTER's advice is based entirely on the law as embodied in cases (and, when completed, in statutes). No attempt is made to take into account new issues of policy, changing social mores, or other factors to which a judge may, openly or otherwise, have regard when coming to a decision. An LES need not have regard to these factors in order to provide useful legal advice. Taking all of these factors into account requires a level of predictive skill which is beyond all LESs—and beyond all but the very best lawyers.

3.2 SHYSTER and AI

Over forty years ago, Loevinger (1949) urged the study of law and legal problems by scientific methods, and named this study "jurimetrics". Since then, several programs have been developed that use statistical methods to analyze previously-decided cases. Gardner (1987) refers to some of these,[6] and asserts:

> These are not AI programs ... The programs are concerned with predicting judicial decisions, or more generally with analyzing judicial behavior, from a data base in which legal rules have no role. Traditional modes of reasoning are replaced by mathematical methods ...[7]

Gardner does not explain *why* she thinks that these "prediction programs"[8] are not AI programs. If a program can successfully predict judicial decisions—even without adopting a "traditional mode of reasoning"—it is at least arguable that it is artificially intelligent.

SHYSTER constructs arguments—legal opinions—based on the model of legal reasoning adopted in §2. Each opinion incorporates a prediction as to the likely result in the instant case. SHYSTER uses statistical methods to decide the cases upon which to base its opinions. This is not to suggest that lawyers decide which cases to use in their arguments by reference to numerical methods. On the contrary, one of the aims of the SHYSTER project is to demonstrate that an LES which makes no attempt to model a lawyer's approach to choosing cases can produce useful advice about cases.

3.3 SHYSTER and case law

SHYSTER adopts, and greatly expands upon, an approach to case law used by the FINDER system.[9] FINDER is a case-based LES which gives advice in the law of trover (the law concerning the ownership of found chattels). This area of law is unusual in that it is based entirely on cases. FINDER's approach to case law is based upon Tyree's mathematical concept of the similarity of cases as described in his paper *The Geometry of Case Law* (1977).

FINDER has a database of leading cases in the law of trover, and a list of the questions which were of legal significance in those cases: e.g. "Was the chattel attached to the land or premises where it was found?" Each of these questions is called an *attribute*. For each of the leading cases, FINDER has a vector of attribute values; each attribute value (YES or NO) answers the corresponding attribute's question for that case. Hence, each vector of attribute values represent the facts

[6] Including Kort 1963, Lawlor 1963, 1972, Borchgrevink and Hansen 1980, and Tyree 1981.
[7] Gardner 1987, pp. 74–5.
[8] Gardner 1987 coins this term on p. 76.
[9] FINDER is described by Tyree 1985, 1986, 1989 and Tyree, Greenleaf and Mowbray 1988, 1989.

of that case. The user provides FINDER with the facts of the instant case by giving a YES or NO answer to each of the attributes.

FINDER assigns a weight to each attribute, equal to the inverse of the variance of the values of that attribute across all the cases.[10] FINDER uses these weights to find the weighted Euclidean distance between the instant case and each of the leading cases. It uses the nearest case, and the nearest case with the opposite result, to build an argument about the likely result in the instant case: i.e. whether or not the finder can keep the found chattel.

SHYSTER uses FINDER's method of assigning weight to attributes, however every other aspect of SHYSTER's handling of cases is either unique to SHYSTER or an improvement of a feature of FINDER.

Most important is SHYSTER's generality. A legal expert can specify an area of law using SHYSTER's case law specification language (see §3.4). Within an area, there can be more than two possible outcomes: SHYSTER is not confined to those areas of law in which all the cases can be divided into two groups on the basis of their results. SHYSTER allows for UNKNOWN attribute values, in the leading cases and the instant case, and employs a more sophisticated method of finding the distance between cases than does FINDER. SHYSTER can deal with two or more cases which are equidistant from the instant case, and can handle attributes with zero variance and, hence, infinite weight.

Gardner cites various writers who identify the following as difficulties associated with this approach to case law: separating findings of fact from legal conclusions; determining what the judges in the leading cases believed the facts to be; categorizing facts appropriately; and deciding what aspects of the facts should be included.[11] But these difficulties are not peculiar to LESs which take a statistical approach to case law. All of these difficulties are inherent in the problem of dealing with case law. SHYSTER expects the legal expert to have regard to these difficulties when specifying an area of case law. This is not an unreasonable expectation—knowing how to overcome these difficulties is one of the characteristics of legal expertise.

3.4 SHYSTER's case law specification language

SHYSTER's case law specification language has been developed to allow a legal expert to specify an area of case law in terms of the leading cases in that area, and the facts in each of those leading cases.[12]

[10] Treating each YES as a "1", and each NO as a "0".

[11] Gardner 1987, p. 75.

[12] Some cases carry more weight than others by virtue of the levels of the courts in which they were heard. SHYSTER's case law specification language allows for the specification of a hierarchy of courts. Future versions of SHYSTER will take this hierarchy, and the time since cases were decided, into account when producing its opinions.

A program in this specification language can specify an arbitrary number of areas of case law. Each area has an arbitrary number of attributes, chosen by the legal expert as being of legal significance in that area. Each area has an arbitrary number of leading cases,[13] and each case has a vector of attribute values which correspond to the specified attributes. Each area has an arbitrary number of results (at least two) and each case is bound to one of these results.

Each value for each attribute can be *directed* towards a result (or results), so that that value for that attribute suggests that result (or results). Furthermore, the legal expert is allowed to specify a *hypothetical*—the ideal combination of attribute values—for each result.

Popple (1990c) describes SHYSTER's case law specification language in detail.

3.5 SHYSTER's module structure

SHYSTER consists of several modules, written in ISO C. The Tokenizer and Parser modules tokenize and parse a specification written in SHYSTER's case law specification language. The Dumper module displays the information that has been parsed in a different format, to simplify the verification of the specification by the legal expert. The Checker module checks for evidence of dependence between the attributes. The Scales module determines the weight to be given to each attribute. The Adjuster module allows the user to adjust the weights of the attributes, or to remove attributes or add new ones. The Consultant module interrogates the user as to the facts—the attribute values—of the instant case. The Odometer module determines the distances between the leading cases and the instant case. And the Reporter module writes a report—a legal opinion as to the likely result.

3.6 Output from SHYSTER

As well as producing a legal opinion, SHYSTER produces a number of intermediate files which give details about how SHYSTER came to that opinion. These intermediate files are not intended to be read by the user; they merely provide the knowledge engineer with information about the internal workings of SHYSTER.

All of the output from SHYSTER, with the exception of the log file, is in LaTeX format: i.e. it is suitable for processing by the LaTeX document processor.[14] This contributes to SHYSTER's portability, and to the aesthetic quality of its output. It also allows some of the output to be displayed in a clear and economical tabular format.

[13] There may be many previously-decided cases in a small area of the law, but most of those merely follow one or more of the leading cases.

[14] LaTeX (Lamport 1986) is a set of macros for Knuth's TeX system (1984).

All of the examples of SHYSTER output in this technical report (the extracts in figures 1, 2 and 3, and the complete report in appendix A) appear exactly as produced by SHYSTER after processing by LaTeX.

4 An example

In this section, the operation of SHYSTER's case-based system is demonstrated using the example of the concept of "authorization" of copyright infringement.

4.1 Authorization of copyright infringement

The *Copyright Act 1968* (as amended) is the statutory component of the law of copyright as it applies in Australia. Sub-sections 13(2), 36(1) and 101(1) forbid the "authorization" of copyright infringement.[15] Nowhere in the Act is there any other reference to "authorization"; the meaning of the word is left entirely to the courts to interpret.

The author—having consulted a legal textbook[16] and the published judgments in the leading cases to which that textbook refers—acted as legal expert and used SHYSTER's case law specification language to specify the case law regarding the meaning of "authorization" in the *Copyright Act*. This specification defines an area of law which is bound to the identifier `Authorization`. It represents the law as it was in 1984 when the textbook was published, so it can be tested against important cases which have been decided since then.

There are ten leading cases in the `Authorization` area. The judges who heard these cases had to consider the following points: whether the person or organization who engaged a band had authorized an infringement of copyright by that band;[17] whether the distributors of a film authorized a cinema proprietor's breach of copyright in showing the film;[18] whether the installer of a juke-box in a shop had authorized the infringing playing of a record;[19] whether a university had authorized its students to infringe copyright by providing photocopying machines in its library;[20] whether advertising blank cassette tapes authorized the public

[15]These sub-sections are quoted in full in appendix B.

[16]Ricketson 1984.

[17]*Performing Right Society Ltd v. Bradford Corporation* [1917–23] MacGillivray's Copyright Cases 309: SHYSTER's C_1; *Mellor v. Australian Broadcasting Commission* [1940] AC 491: C_3; *Australasian Performing Right Association Ltd v. Canterbury-Bankstown League Club Ltd* [1964–65] NSWR 138: C_5; *Performing Right Society Ltd v. Ciryl Theatrical Syndicate Ltd* [1924] 1 KB 1: C_7; *Australasian Performing Right Association Ltd v. Miles* [1962] NSWR 405: C_{10}.

[18]*Falcon v. Famous Players Film Company* [1926] 2 KB 474: C_2.

[19]*Winstone v. Wurlitzer Automatic Phonograph Co. of Australia Pty Ltd* [1946] VLR 338: C_4.

[20]*University of New South Wales v. Moorhouse* (1975) 133 CLR 1: C_6.

to infringe copyright;[21] and whether a newspaper article about recording albums from the radio authorized readers to infringe.[22]

There are seven attributes in the `Authorization` area. The questions associated with these attributes are: "was the infringer an employee of the accused?", "was the infringer an independent contractor to the accused?", "did the accused sell or hire the infringer the means of infringing?", "did the accused have the power to prevent the infringement?", "did the accused take reasonable steps to avoid the infringement?", "did the accused know, or have reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done?", and "was the specific infringement causally related to an incitement to infringe on the part of the accused?"

4.2 Processing the case law specification

The Tokenizer takes the specification of the `Authorization` area and breaks it into its component tokens. The Parser parses those tokens, and builds an internal representation of each area of case law as specified.

The Dumper module produces a LaTeX file (the *dump file*) which reflects SHYSTER's internal representation of the specification that has just been parsed. This allows easy verification of that specification.

For the most part, the dump file is just a nicely formatted version of the specification. However, the attribute vectors for all of the cases are brought together to form an attribute matrix. Figure 1 shows the attribute matrix for the `Authorization` area, as extracted from the dump file.

The specification allows for three possible results: `Auth` means that the accused authorized the infringement, `Not-Auth` means that the accused did not authorize the infringement, and `Liable` means that the accused is directly or vicariously liable for the infringement.

The cases have been grouped together by their results, then labelled $C_1 \ldots C_{10}$ in the order of their appearance within each result. A hypothetical has been specified for each result (H_{Auth}, $H_{\text{Not-Auth}}$ and H_{Liable}). Each hypothetical represents the ideal combination of attribute values for its result.

The attributes are labelled $A_1 \ldots A_7$ in the order of their appearance in the specification. The attribute values are represented by a $\bullet$ symbol for YES, a $\times$ symbol for NO, and a blank space for UNKNOWN.

4.3 Assigning weights to attributes

The Scales module determines a weight for each attribute in each area. Each YES is assigned a value of 1; each NO is assigned a value of 0. These values are

[21] *A & M Records Inc. v. Audio Magnetics Inc. (UK) Ltd* [1979] FSR 1: C_8.
[22] *RCA Corporation v. John Fairfax and Sons Ltd* [1981] 1 NSWLR 251: C_9.

Case	*Attributes*							*Result*
	A_1	A_2	A_3	A_4	A_5	A_6	A_7	
C_1	×	•	×	•	×	•	•	Auth
C_2	×	×	•	×	×	•	•	
C_3	×	•	×	•	×	•	•	
C_4	×	×	•	•	×	•	•	
C_5			×	•	×	•	•	
C_6	×	×	•	•	×	•	×	
H_{Auth}	×	•	•	•	×	•	•	
C_7	×	•	×	•	×	×	×	Not-Auth
C_8	×	×	•	×	×	•	×	
C_9	×	×	×	×	×	•	×	
$H_{\text{Not-Auth}}$	×	×	×	×	•	×	×	
C_{10}	•	×	×	•	×	•	•	Liable
H_{Liable}	•	×		•	×	•		

Figure 1: Extract from the dump file for the `Authorization` area (SHYSTER output).

completely arbitrary—although they must be different—as they form the basis of calculations to determine relative weights of attributes and relative distances between cases.

The weight w of each attribute is defined as the inverse of the variance σ^2 of that attribute. This is diametrically opposite to the standard approach adopted in statistical classification problems which deems high-variance variables to be the most important.[23] Tyree (1989) justifies this approach as follows:

> It is not that low-variance facts are of themselves important, but that low-variance relevant facts are more important than high-variance relevant facts. They are the facts which have been included by the expert in spite of the fact that they do not appear to assist greatly in the separation of the cases into two classes.[24]

Every attribute value is either 0 or 1, so $0 \leq \sigma^2 \leq 0.25$. Consequently, $4 \leq w \leq \infty$.[25]

[23] Tyree 1989, p. 149, n. 16.

[24] Tyree 1989, p. 141. Tyree refers to separating the cases into two classes because FINDER allows only two results for each leading case. SHYSTER allows an arbitrary number of results in each specified area of law.

[25] The `Odometer` treats infinitely heavy attributes as a special case when calculating the distance between cases. A distance of "$2\infty + x$" is greater than "$\infty + y$", regardless of the values of x and y.

Attr.	μ_{Auth}	$\mu_{\text{Not-Auth}}$	μ_{Liable}	μ	σ^2	w
A_1	0.00	0.00	1.00	0.11	0.10	10.12
A_2	0.40	0.33	0.00	0.33	0.22	4.50
A_3	0.50	0.33	0.00	0.40	0.24	4.17
A_4	0.83	0.33	1.00	0.70	0.21	4.76
A_5	0.00	0.00	0.00	0.00	0.00	∞
A_6	1.00	0.67	1.00	0.90	0.09	11.11
A_7	0.83	0.00	1.00	0.60	0.24	4.17

Figure 2: Extract from the weights file for the `Authorization` area (SHYSTER output).

The Scales module writes all of the mean (μ), variance and weight figures to a LaTeX file (the *weights file*). Figure 2, extracted from the weights file, gives the figures for the `Authorization` area.

(The columns headed μ_{Auth}, $\mu_{\text{Not-Auth}}$ and μ_{Liable} contain the means of each attribute for the cases with that result. Each of these columns, considered as a vector of means, is termed a *centroid*. The use of centroids in generating SHYSTER's opinion is explained in §4.7.)

The attribute A_5 has been given infinite weight, so SHYSTER sees it as being enormously important. A_5 corresponds to the question "did the accused take reasonable steps to avoid the infringement?"[26] In all ten leading cases, the answer to this question is "no". Yet, the legal expert has chosen this as one of the attributes, because judges have consistently asked themselves this question when deciding what constitutes "authorization".

It is clear from the written judgments in the leading cases that, if the accused does take reasonable steps to avoid the infringement, she/he will not be taken to have authorized that infringement. It is not surprising that in none of the leading

[26] This question could easily be characterized as open-textured itself. Yet the point of the `Authorization` area is to help the user to determine the meaning of the open-textured concept "authorization".

There are two potential approaches to this problem. SHYSTER could invoke its case-based component a second time in order to determine what constitute "reasonable steps". This would require a further specification capturing the meaning of "reasonable steps" as embodied in case law. Alternatively, where the open-textured attribute is weighted very heavily (as in this example), SHYSTER could simply mark the attribute as being a pivotal attribute. The user could then be informed that the result of the instant case depends very heavily on the open-textured attribute.

This latter approach does not significantly reduce SHYSTER's usefulness because the original problem ("was the infringement authorized") is simplified to a smaller sub-problem ("did the accused take reasonable steps ...").

cases did the accused take reasonable steps. If reasonable steps had been taken, it is unlikely that such a case would be pursued very far through the judicial system—and even less likely that it would be deemed important enough to be reported.[27]

After A_5, the next two attributes with the greatest weight are A_6 and A_1. These attributes correspond to the questions "did the accused know, or have reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done?" and "was the infringer an employee of the accused?".

The Adjuster module allows the user to adjust attribute weights and observe the effect of those adjustments upon SHYSTER's operation. The Adjuster also allows attributes to be removed, or added (with a user-specified weight) to facilitate experimentation within each area of case law.

4.4 Detecting attribute dependence

The assignment of weights to attributes, performed by the Scales module, assumes that the attributes chosen by the legal expert are independent. The Checker module warns the legal expert if there is functional dependence, or evidence of stochastic dependence, between attributes. Popple (1991b) describes this process in detail.

4.5 Determining the facts of the instant case

The Consultant module interrogates the user as to the attribute values of the instant case. The prototype's modular design is such that any desired interface could be employed. At present, a simple scrolling prompted dialogue is used. The Consultant module constructs a vector of attribute values representing the legally significant facts in the instant case. For the purposes of this example, the facts in the instant case are the same as those in *Australasian Performing Right Association Ltd v. Jain*:[28] a case which arose after the publication of the textbook which was used to prepare the specification of the `Authorization` area.

4.6 Measuring distance and similarity

With an attribute vector representing the facts in the instant case, the Odometer module determines the distances between the instant case and each of the leading

[27]If the accused in the instant case *did* take reasonable steps to avoid the infringement, then SHYSTER's method of calculating the distance between cases (explained in §4.6) would consider all of the leading cases to be infinitely distant from the instant case. However, because it has a value of YES for A_5, $H_{\text{Not-Auth}}$ would be comparatively near to the instant case, and much nearer than all the leading cases and hypotheticals; so SHYSTER's opinion would be that the accused had not authorized the infringement.

[28](1990) AIPC ¶90-718.

cases, the hypotheticals and the centroids.

SHYSTER calculates two different types of distance: the *known distance* (d_{K}) is defined as the sum of the weights of every attribute for which those two cases have different known values;[29] the *unknown distance* (d_{U}) is defined as the sum of the weights of every attribute for which either of the two cases has an unknown value.

The smaller the distance between two cases, the more similar—the nearer—those two cases are. A known distance of zero indicates that the two cases are identical—at least as far as the known attributes are concerned. A large unknown distance indicates that the values of some important (i.e. heavily weighted) attributes were unknown, casting some doubt on the accuracy of the known distance calculation for that case. The unknown distance can be thought of as a measurement of possible error: it is the maximum distance that could be added to the known distance if all of the unknown attribute values were known.

The Odometer writes a LaTeX file (the *distances file*) which gives the distances between each of the leading cases and the instant case. Figure 3 is extracted from the distances file for this example. The facts of the instant case are displayed in the row labelled C_{Instant}.

Distance measures are one of three kinds of measures that are used in cluster analysis to determine similarity between cases—the other two are association coefficients and correlation coefficients. Statisticians make use of many different similarity measures, but—for SHYSTER—most of the commonly used similarity measures reduce to one of these three formulae for the similarity/distance between two cases j and k:[30]

- distance measure: $$d_{jk} = \Delta_{jk}$$
- association coefficient: $$S_{jk} = \frac{\Delta_{jk}}{n}$$
- correlation coefficient: $$r_{jk} = \frac{\sum_{i=1}^{n}\left(A_{ij} - \bar{A}_j\right)\left(A_{ik} - \bar{A}_k\right)}{\sqrt{\sum_{i=1}^{n}\left(A_{ij} - \bar{A}_j\right)^2 \sum_{i=1}^{n}\left(A_{ik} - \bar{A}_k\right)^2}}$$

where Δ_{jk} is the number of differences in the corresponding attribute values of case j and case k, n is the number of attributes, A_{ij} is the value of the ith attribute for the jth case, and $\bar{A}_j$ is the mean of all attribute values for the jth case.

[29] The known distance is the same as FINDER's weighted Euclidean distance.

[30] See Popple 1992 for details of these reductions.

These measures can be weighted to take into account the importance of each attribute:

- weighted distance measure: $$d'_{jk} = \sum_{i=1}^{n} \left| A_{ij} - A_{ik} \right| \times w_i$$
- weighted association coefficient: $$S'_{jk} = \frac{\sum_{i=1}^{n} \left| A_{ij} - A_{ik} \right| \times w_i}{\sum_{i=1}^{n} w_i}$$
- weighted correlation coefficient: $$r'_{jk} = \frac{\sum_{i=1}^{n} \left(A_{ij} \times w_i - \bar{A}'_j \right) \left(A_{ik} \times w_i - \bar{A}'_k \right)}{\sqrt{\sum_{i=1}^{n} \left(A_{ij} \times w_i - \bar{A}'_j \right)^2 \sum_{i=1}^{n} \left(A_{ik} \times w_i - \bar{A}'_k \right)^2}}$$

where w_i is the weight of the ith attribute, and $\bar{A}'_j$ is the weighted mean of all attribute values for the jth case.

The known and unknown distances are both variations on the weighted distance measure d'_{jk}. SHYSTER also calculates values of d_{jk}, S_{jk}, S'_{jk}, r_{jk} and r'_{jk}—comparing the instant case with each leading case, hypothetical and centroid.[31] $0 \leq d_{jk} \leq n$; $0 \leq S_{jk} \leq 1$; $0 \leq S'_{jk} \leq 1$; $-1 \leq r_{jk} \leq 1$; $-1 \leq r'_{jk} \leq 1$. The smaller the values of d_{jk}, S_{jk} and S'_{jk}, the more similar the two cases; the larger the values of r_{jk} and r'_{jk}, the more similar the two cases.

As can be seen in figure 3, the Odometer writes the values of these extra similarity measures to the distances file. (The distance measure column is labelled Δ rather than d to avoid confusion with the d_{K} and d_{U} columns.) If any of the weights are infinite, the values obtained for S' become meaningless; SHYSTER will not display (or use) values for S' if any of the attributes are infinitely weighted, as in this example.

Displaying these extra similarity measures with the known and unknown distances allows comparison of different similarity measures during the development and refinement of SHYSTER. SHYSTER uses these extra similarity measures when choosing between equidistant results (see §5).

[31] The value of each centroid element (a number n in the range 0 to 1) is rounded to the nearest attribute value ($0 \leq n < 0.5$: NO; $0.5 \leq n \leq 1$: YES). However, the actual values of the centroid elements are used when calculating the correlation coefficients r and r'.

Case	*Attributes* A_1	A_2	A_3	A_4	A_5	A_6	A_7	d_{K}	d_{U}	Δ	S	r	r'	*Result*
C_{Instant}	$\times$	$\bullet$	$\times$	$\bullet$	$\times$	$\bullet$	$\times$							
C_1	$\times$	$\bullet$	$\times$	$\bullet$	$\times$	$\bullet$	$\bullet$	4.17	–	1	0.14	0.75	0.93	
C_2	$\times$	$\times$	$\bullet$	$\times$	$\times$	$\bullet$	$\bullet$	17.60	–	4	0.57	−0.17	0.63	
C_3	$\times$	$\bullet$	$\times$	$\bullet$	$\times$	$\bullet$	$\bullet$	4.17	–	1	0.14	0.75	0.93	Auth
C_4	$\times$	$\times$	$\bullet$	$\bullet$	$\times$	$\bullet$	$\bullet$	12.83	–	3	0.43	0.17	0.74	$\Rightarrow \infty+30.50$
C_5			$\times$	$\bullet$	$\times$	$\bullet$	$\bullet$	4.17	14.62	1	0.20	0.67	0.92	$\stackrel{H}{\Rightarrow} 4.50$
C_6	$\times$	$\times$	$\bullet$	$\bullet$	$\times$	$\bullet$	$\times$	8.67	–	2	0.29	0.42	0.82	
H_{Auth}	$\times$	$\bullet$	$\bullet$	$\bullet$	$\times$	$\bullet$	$\bullet$	8.33	–	2	0.29	0.55	0.88	
μ_{Auth}	$\times$	$\times$	$\bullet$	$\bullet$	$\times$	$\bullet$	$\bullet$	12.83	–	3	0.43	0.54	0.88	
C_7	$\times$	$\bullet$	$\times$	$\bullet$	$\times$	$\times$	$\times$	11.11	–	1	0.14	0.73	0.28	Not-Auth
C_8	$\times$	$\times$	$\bullet$	$\times$	$\times$	$\bullet$	$\times$	13.43	–	3	0.43	0.09	0.74	$\Rightarrow 14.29$
C_9	$\times$	$\times$	$\times$	$\times$	$\times$	$\bullet$	$\times$	9.26	–	2	0.29	0.47	0.86	$\stackrel{H}{\Rightarrow} 8.33$
$H_{\mathrm{Not\text{-}Auth}}$	$\times$	$\times$	$\times$	$\times$	$\bullet$	$\times$	$\times$	∞+20.37	–	4	0.57	−0.35	−0.30	$\stackrel{\mu}{\Rightarrow} 4.17$
$\mu_{\mathrm{Not\text{-}Auth}}$	$\times$	$\times$	$\times$	$\times$	$\times$	$\bullet$	$\times$	9.26	–	2	0.29	0.77	0.93	
C_{10}	$\bullet$	$\times$	$\times$	$\bullet$	$\times$	$\bullet$	$\bullet$	18.79	–	3	0.43	0.17	0.48	Liable
H_{Liable}	$\bullet$	$\times$		$\bullet$	$\times$	$\bullet$		14.62	8.33	2	0.40	0.17	0.41	$\Rightarrow \infty+15.87$
μ_{Liable}	$\bullet$	$\times$	$\times$	$\bullet$	$\times$	$\bullet$	$\bullet$	18.79	–	3	0.43	0.17	0.48	

Figure 3: Extract from the distances file for the `Authorization` area (SHYSTER output).

4.7 Finding the nearest cases

SHYSTER considers a case j to be nearer to the instant case than a case k if

$$j_{d_{\mathrm{K}}} + j_{d_{\mathrm{U}}} < k_{d_{\mathrm{K}}} + k_{d_{\mathrm{U}}}$$

where $j_{d_{\mathrm{K}}}$ is the known distance for case j. The result of the case that is nearest to the instant case is termed the *nearest result*.

For every result—the nearest result and the other results—the Odometer determines the *nearest known case* (the nearest case with zero unknown distance) and the *nearest unknown case* (the nearest case with some unknown distance). If two (or more) of these nearest cases are equidistant from the instant case, SHYSTER uses both (or all) of them when constructing its opinion.[32] The nearest cases for the nearest result are called the *nearest neighbours*. The nearest cases for the other results are called the *nearest others*.

In figure 3, the nearest result is `Auth`. The nearest neighbours are C_1 and C_3 (the nearest known cases for the `Auth` result) and C_5 (the nearest unknown case for that result). The nearest others are C_9 and C_{10}: the nearest known cases for the `Not-Auth` and `Liable` results respectively; neither of these other results has a nearest unknown case.

The nearest hypothetical is H_{Auth}. It is reasonable to expect that the result in the nearest hypothetical will be the same as that in the nearest neighbour; after all, the nearest hypothetical represents the *ideal* combination of attributes for its result. If the nearest result is different to the result of the nearest hypothetical then there is cause for concern—especially if the nearest hypothetical is nearer to the instant case than is the nearest neighbour, in which case SHYSTER bases its opinion on the nearest hypothetical.[33]

Similarly, it is reasonable to expect that the result in the nearest centroid will be the same as that in the nearest neighbour. However, μ_{Auth} is not the nearest centroid in this example: $\mu_{\mathrm{Not\text{-}Auth}}$ is nearer to C_{Instant}. This is a small cause for concern, but SHYSTER does not let it affect its opinion because the nearest neighbours are nearer to the instant case than is the nearest centroid.

As mentioned in §3.4, SHYSTER allows the legal expert to direct an attribute value towards a certain result, or results. For example, an answer of YES to attribute 3 in the `Authorization` area is directed towards a result of `Auth`. This is because the fact that the accused sold or hired the infringer the means of infringing (A_3 = YES) suggests that the accused authorized the infringement (`Auth`). Such a fact is not conclusive, however: in *A & M Records Inc. v. Audio Magnetics Inc. (UK) Ltd*[34]—SHYSTER's C_8—the accused company was held not

[32] However, SHYSTER does not allow equidistant results and will always choose a single result to be the "nearest". How SHYSTER chooses between equidistant results is explained in §5.

[33] The use of hypotheticals as a safeguard against providing misleading advice is suggested by Tyree et al. 1988 (who call them *ideal points*) but is not implemented in FINDER.

[34] [1979] FSR 1.

to have authorized the infringement, despite the fact that it had sold the infringer the means of infringing.

For each result, the Odometer sums the weights of each attribute for which the value of that attribute in the instant case is directed towards that result. This sum is termed a *direction.* The larger—the stronger—a direction, the greater the extent to which the facts of the instant case "direct" SHYSTER towards that result.

SHYSTER's attribute direction is based on a feature of Ashley's HYPO system. HYPO represents the "factors" that favour each side, and treats a problem as a collection of usually competing factors. All factors are required to favour one side or the other.[35] SHYSTER does not make this requirement, because not all attribute values can be directed towards a result.[36] Hence, SHYSTER does not use directions as the basis for its opinions, but uses them as a safeguard against providing incorrect advice.

The Odometer calculates three directions for each result. The *specified direction* $\Rightarrow$ is calculated using the legal expert's attribute direction in the case law specification. The *hypothetical direction* $\stackrel{H}{\Rightarrow}$ is calculated using hypotheticals. If a hypothetical is the only hypothetical in the area with a given value for an attribute then that value for that attribute is considered to be directed towards the hypothetical's result. By an analogous method, the *centroid direction* $\stackrel{\mu}{\Rightarrow}$ is calculated using each result's centroid.

Non-zero directions are displayed in the *Result* column. In figure 3, the strongest specified direction confirms SHYSTER's choice of `Auth` as the nearest result. The strongest hypothetical and centroid directions suggest a different result: `Not-Auth`. However, this is not sufficient to shake SHYSTER's confidence in its opinion; SHYSTER only refers to the hypothetical and centroid directions if the specified direction suggests a result different to the nearest result.

4.8 Preparing the report

The Reporter module constructs a legal opinion as to the likely outcome given the facts of the instant case.

The Reporter opens with some introductory comments about the area of law, then boldly declares its opinion[37] that the result in the instant case will be the nearest result. It supports this assertion by reference to the nearest cases, and

[35] Ashley 1989, p. 29. HYPO allows only two results.

[36] For example, although an answer of YES to attribute 3 can be directed towards `Auth`, an answer of NO for that attribute cannot be directed towards either of the other results: `Not-Auth` or `Liable`. This is because the fact that the accused did not sell or hire the infringer the means of infringing (A_3 = NO) does not suggest that the accused did not authorize the infringement (`Not-Auth`) or that the accused is directly or vicariously liable for the infringement (`Liable`).

[37] Insofar as a program can have an opinion.

```
FOR the nearest result
    IF the nearest case is an unknown case THEN
        use the nearest unknown case;
        use the nearest known case;
    ELSE
        use the nearest known case;
        IF (were it not for its unknown distance)
                the nearest unknown case would be nearer
                the instant case than the nearest known case THEN
            use the nearest unknown case;
        END
    END
END

FOR every other result
    IF the nearest case is an unknown case OR
            (were it not for its unknown distance)
            the nearest unknown case would be nearer
            the instant case than the nearest result's nearest case THEN
        use the nearest unknown case;
    END
    use the nearest known case;
END
```

Figure 4: Algorithm used by the Reporter module to choose the cases upon which to base its opinion.

closes with some concluding comments about the area.[38]

An algorithm that shows which cases (and the order in which those cases) are used by the Reporter to construct SHYSTER's opinion is shown in Figure 4. This (simplified) algorithm assumes that there is only one nearest known case and one nearest unknown case for each result. If there are two or more equidistant nearest cases, each nearest case is used—one after another.

How each case is "used" varies depending on several factors.

Each case is summarized, then the similarities and differences between the case and the instant case are explained. If the case is an unknown case, the attributes for which values are unknown are also explained.

For the nearest result, it is argued that (because of the similarities, and despite

[38] The specification of the `Authorization` area includes opening comments, but not closing comments.

the differences) the result in the instant case should be the same. For every other result, it is argued that (because of the differences, and despite the similarities) the result in the instant case should be different.

If SHYSTER's opinion is a desirable result for the user, she/he can use SHYSTER's discussion of the nearest neighbours, and the differences between the nearest neighbours and the instant case, as the basis for a legal argument. Alternatively, if SHYSTER's opinion is not a desirable result for the user, she/he can base a legal argument upon SHYSTER's discussion of the nearest others.

A full report for the example instant case is presented in appendix A.

5 Evaluating SHYSTER's report

Given the relative lack of empirical data in the legal domain, there are only two ways in which SHYSTER's legal advice can be tested. The facts of some real cases (not selected by the legal expert as being leading cases) can be given to SHYSTER, then SHYSTER's advice compared with the result in those real cases. Alternatively, the legal expert can be asked to formulate some hypothetical cases together with advice as to the expected result, then SHYSTER's advice can be compared with that of the legal expert.

The instant case in the above example had the same facts as those in *Australasian Performing Right Association Ltd v. Jain*, which concerned the unlicensed performance of musical works in a tavern. SHYSTER's opinion about the likely result is the same as the view of the Full Court of the Federal Court of Australia which held that the proprietor of the tavern authorized the infringement.

The facts of three other reported cases were given to SHYSTER.[39] None of these three was among the leading cases included in the specification of the `Authorization` area—indeed, two of these cases (like *APRA v. Jain*) were decided after the publication of the textbook upon which the specification was based. In each case, SHYSTER came to the same conclusion as did the court in the actual case.

Furthermore, SHYSTER was given the facts for two hypothetical problems which were chosen by a legal expert as being too difficult to predict with confidence. For one of these hypothetical problems, SHYSTER found a nearest case which was only fractionally nearer to the instant case than another case with a different result. For the other hypothetical problem, SHYSTER found equidistant nearest cases with different results. Only after reference to the extra similarity measures discussed in §4.6, the nearest hypothetical and centroid, and the attribute directions could SHYSTER decide which result was the "nearest".[40]

[39] *CBS Inc. v. Ames Records and Tapes Ltd* (1982) Ch 91; *WEA International Inc. v. Hanimex Corporation Ltd* (1987) AIPC ¶90-428; *CBS Songs Ltd v. Amstrad Consumer Electronics plc* (1988) AC 1013.

[40] In these circumstances, the user is warned that SHYSTER is having difficulty making a

6 Building a hybrid system

As discussed above, the SHYSTER project is concerned with the development of a hybrid LES that combines a rule-based system with a case-based system. At present, only the case-based part of SHYSTER has been developed.

When fully developed, the rule-based system will represent the law as embodied in legislation. When the rule-based system encounters an open-textured concept, it will trigger the case-based system. The process of triggering the case base uses SHYSTER's concept of an area of law.

SHYSTER's case-based system takes an area identifier and, after soliciting the instant facts from the user, produces a report. In the existing SHYSTER prototype, the area is chosen by the user entering an identifier: in the above example, the user enters "`Authorization`".

In the completed hybrid SHYSTER system, an area will be specified for every open-textured statutory concept represented in the rule base. When an open-textured concept is encountered, an identifier will be passed to the case base indicating that advice is sought as to the meaning of that open-textured concept. The case-based system will interrogate the user, produce an opinion, then return control to the rule-based system. Any number of open-textured concepts can be handled in this fashion.

The hybrid system will give advice as to the application of the relevant legislation (using a rule-based system) then make reference to reports (produced by the case-based system) which give advice as to the meaning of the relevant open-textured concepts.

So, for example, the case-based system will be triggered to give an opinion in the `Authorization` area whenever the rule-based system needs to know whether copyright infringement has been authorized pursuant to sub-section 13(2), 36(1) or 101(1) of the *Copyright Act 1968*.

7 Conclusion

Early testing of SHYSTER shows that despite—or, perhaps, because of—the fact that it does not model a lawyer's approach to choosing cases, it produces useful advice in two areas of case law.

Specification of the `Finder` area causes SHYSTER to simulate FINDER: a system which has been demonstrated to produce useful and accurate legal opinions in a small area of Australian/English law. Popple (1990c) gives details of this simulation.

Using the specification of the `Authorization` area (described in this technical report), SHYSTER came to the same opinion as did the judges in four real cases—

decision about which is the nearest result.

three of which are the only reported cases to have been decided in this area since the publication of the textbook upon which the specification was based.

The fact that SHYSTER's case-based system performs so well in domains as different as the law of trover and the law of authorization of copyright infringement suggests that SHYSTER's approach to case law may prove successful in other areas of law.

Future research will involve specification of other areas of law. Legal experts who know nothing of the internal workings of SHYSTER will be asked to write specifications—to ensure that successful specification does not require knowledge of the mechanics of SHYSTER, and to test the author's belief that legal experts will have little difficulty specifying areas of case law using SHYSTER's case law specification language. Several legal experts will be asked to specify the same area of law, and those specifications will be tested to see whether they are functionally equivalent.

Finally, once the case-based system has been fully developed, it will be combined with a rule-based system to produce a powerful hybrid LES.

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Appendix A: Report file (SHYSTER output)

The notion of authorization extends beyond the authority given by an agent. The word "authorize" should be "... understood in its ordinary dictionary sense of 'sanction, approve, and countenance.'"[1]

"[A] person who has under his control the means by which an infringement of copyright may be committed ... and who makes it available to other persons, knowing, or having reason to suspect, that it is likely to be used for the purpose of committing an infringement, and omitting to take reasonable steps to limit its use to legitimate purposes, would authorize any infringement that resulted from its use."[2]

In my opinion—following *Performing Right Society Ltd v. Bradford Corporation* and *Mellor v. Australian Broadcasting Commission*—the accused authorized the infringement.

In *Performing Right Society Ltd v. Bradford Corporation*,[3] a decision of the King's Bench Division of the English High Court of Justice, the Performing Right Society owned the copyright in several works which were performed without their consent at

[1] *Falcon v. Famous Players Film Company* [1926] 2 KB 474 at 491, per Bankes LJ.
[2] *University of New South Wales v. Moorhouse* (1975) 133 CLR 1 at 13, per Gibbs J.
[3] [1917–23] MacGillivray's Copyright Cases 309.

the Bradford Baths. Roche J held that the bandmaster was an agent of the Bradford Corporation "... none the less because he was an independent contractor in engaging his assistants in playing the music."[4]

It was claimed by the Corporation, whose attention had been drawn by the Performing Right Society to previous infringements, that they had warned the musical director to warn the musicians not to perform copyright songs. However, Roche J was not convinced that this warning had actually reached the musicians. And the fact that copyright works "... had found their way to and were printed on the corporation's programme ..."[5] meant that they had authorized the performance.

There are several significant similarities between the instant case and *PRS v. Bradford*: the infringer was not an employee of the accused, the infringer was an independent contractor to the accused, the accused did not sell or hire the infringer the means of infringing, the accused had the power to prevent the infringement, the accused did not take reasonable steps to avoid the infringement, and the accused knew, or had reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done.

However, the instant case is not on all fours with *PRS v. Bradford*. In that case the specific infringement was causally related to an incitement to infringe on the part of the accused.

In *Mellor v. Australian Broadcasting Commission*,[6] a decision of the Judicial Committee of the Privy Council, Mellor and others held the sole right to perform in public in Australia musical works arranged for performance by brass and military bands. They published and distributed advertising pamphlets which included a statement that all of their sheet music was "... 'Free for Public Performance' anywhere ... We have paid for the performing rights of every piece we issue ..."[7] The ABC engaged bands to play some of this music, and broadcast the bands' performances on radio.

The Privy Council held that the ABC had authorized the bands to perform the musical works. However, the ABC had not infringed the plaintiffs' sole right to authorize public performance because the statements made in the plaintiffs' pamphlets amounted to consent.

There are several significant similarities between the instant case and *Mellor v. ABC*: the infringer was not an employee of the accused, the infringer was an independent contractor to the accused, the accused did not sell or hire the infringer the means of infringing, the accused had the power to prevent the infringement, the accused did not take reasonable steps to avoid the infringement, and the accused knew, or had reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done.

However, the instant case is not on all fours with *Mellor v. ABC*. In that case the specific infringement was causally related to an incitement to infringe on the part of the accused.

If *RCA Corporation v. John Fairfax and Sons Ltd* is followed then the accused did not

[4] [1917–23] MacGillivray's Copyright Cases 309 at 312.
[5] [1917–23] MacGillivray's Copyright Cases 309 at 313.
[6] [1940] AC 491.
[7] [1940] AC 491 at 498–9.

authorize the infringement.

In *RCA Corporation v. John Fairfax and Sons Ltd*,[8] a decision of the Supreme Court of New South Wales, the defendant's newspaper the *Sun-Herald* carried an article which pointed out that, using cassette tapes and good quality taping equipment, the same album can be taped by many people. It also discussed how the advent of FM radio had made it easy for people to tape new album and single releases without buying the discs: "Why spend nearly $10 on the new David Bowie album when you can tape it from 2JJJ?"[9]

Kearney J held that "... authorization involves some element of causation—and hence the necessity for some relationship creating a link or connection however tenuous between the authorizer and the infringer."[10] There was no such link, so John Fairfax and Sons had not authorized any infringement.

There are several similarities between the instant case and *RCA v. Fairfax*: the infringer was not an employee of the accused, the accused did not sell or hire the infringer the means of infringing, the accused did not take reasonable steps to avoid the infringement, the accused knew, or had reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done, and the specific infringement was not causally related to an incitement to infringe on the part of the accused.

However, there are two very significant differences between the instant case and *RCA v. Fairfax.* In that case the infringer was not an independent contractor to the accused, and the accused did not have the power to prevent the infringement.

Consequently, there is nothing in *RCA v. Fairfax* to warrant any change in my conclusion.

If *Australasian Performing Right Association Ltd v. Miles* is followed then the accused is liable (directly or vicariously) for the infringement.

In *Australasian Performing Right Association Ltd v. Miles*,[11] a decision of the Supreme Court of New South Wales, the Dee Why RSL Club engaged a band to play at a dance held at the club. During the dance the band played *I've Got a Lovely Bunch of Coconuts*, the copyright in which was owned by the Australasian Performing Right Association.

Jacobs J held that the members of the band were servants of the club, because "... the club through its officers was exercising a control over the work performed in such a way as to show that there was an authority to command the orchestra in its performance."[12] So the members of the club, through the band, performed the musical work and infringed the copyright.

There are several similarities between the instant case and *APRA v. Miles*: the accused did not sell or hire the infringer the means of infringing, the accused had the power to prevent the infringement, the accused did not take reasonable steps to avoid

[8] [1981] 1 NSWLR 251.
[9] [1981] 1 NSWLR 251 at 252.
[10] [1981] 1 NSWLR 251 at 259.
[11] [1962] NSWR 405.
[12] [1962] NSWR 405 at 407.

the infringement, and the accused knew, or had reason to anticipate or suspect, that the infringing act was to be, or was likely to be, done.

However, there are several significant differences between the instant case and *APRA v. Miles*. In that case the infringer was an employee of the accused, the infringer was not an independent contractor to the accused, and the specific infringement was causally related to an incitement to infringe on the part of the accused.

Consequently, there is nothing in *APRA v. Miles* to warrant any change in my conclusion.

Appendix B: Extracts from the Copyright Act

13. (2) For the purposes of this Act, the exclusive right to do an act in relation to a work, an adaptation of a work or any other subject-matter includes the exclusive right to authorize a person to do that act in relation to that work, adaptation or other subject-matter.

36. (1) Subject to this Act, the copyright in a literary, dramatic, musical or artistic work is infringed by a person who, not being the owner of the copyright, and without the licence of the owner of the copyright, does in Australia, or authorizes the doing in Australia of, any act comprised in the copyright.

101. (1) Subject to this Act, a copyright subsisting by virtue of this Part [copyright in subject-matter other than works] is infringed by a person who, not being the owner of the copyright, and without the licence of the owner of the copyright, does in Australia, or authorizes the doing in Australia of, any act comprised in the copyright.

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