

Achieving Fluency in Modernized and Formalized Hohfeld: Puzzles and Games for the LEGAL RELATIONS Language

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Abstract

A significant refinement has been made in the A-HOHFELD representation language, linking it realistically to decisions being made in the legal system, and it has been renamed to become the LEGAL RELATIONS Language. Similar changes have been made in the underlying A-HOHFELD logic, which has become the Logic of LEGAL RELATIONS. A series of 27 puzzles and games, designed to enable legal problem solvers to become fluent in the LEGAL RELATIONS Language, are described and illustrated briefly in this article. More detailed presentation of the Play-A-Round puzzles and the Clever Plaintiff and the Legal Argument games are available at Internet site: <http://thinkers.law.umich.edu>.

1. Introduction

The LEGAL RELATIONS Language (LRL) and its underlying Logic of Legal Relations (LLR) is a modernized and formalized extension of the fundamental legal conceptions of Wesley N. Hohfeld, who in future years is likely to be remembered as one of, if not the, foremost legal philosopher of the Twentieth Century [Hohfeld, 1913]. In his fundamental legal conceptions Hohfeld was seeking to create the "lowest common denominators" of all legal discourse for use in analyzing appellate court opinions. The transformation of the fundamental legal conceptions into LEGAL RELATIONS has been achieved by appropriate modernization and formalization of the A-HOHFELD Logic underlying the A-HOHFELD Language. The modernization includes (1) modification to facilitate formalization of the underlying logic, (2) extension to achieve Hohfeld's objective of being sufficiently robust to express all legal states of affairs and changes in such states, and (3) enrichment to adequately distinguish the full panorama of the solely deontic (unconditional) LEGAL RELATIONS. [Allen 1995,1996; Allen & Saxon 1995] The A-HOHFELD Language has been used as a

representation language for building legal interpretation-assistance (expert) systems for multiple structural interpretations of sets of legal rules, as well for detecting and representing structural ambiguities in legal documents (constitutions, statutes, regulations, contracts, and other written legal materials), and it can, of course, be used for the purposes of case analysis envisioned by Hohfeld [Allen & Saxon 1986, 1991a, 1991b, 1993, 1994]. In this article the A-HOHFELD Language and Logic are being significantly changed and re-named, and application of the newly named language and logic (LRL and LLR) is being significantly extended in an important respect. Hohfeld applied fundamental legal conceptions to the analysis of legal arguments in court opinions; the LRL presented here applies to all legal arguments. In addition to its Hohfeldian roots, LRL and its underlying LLR, can be viewed as extensions of the senior author's early efforts to explore the extent to which normalization techniques on propositional logic can be used to represent legal rules. [Allen, 1957, 1968, 1974, 1982, 1983] The logics involved in LRL and LLR includes a conditional based on relevance logics as well as alethic, deontic, action, and quantifier logics. [Allen & Saxon, 1986, 1991b]

Until now LRL has been called the A-HOHFELD Language, a language based on a quantified modal logic called A-HOHFELD Logic. An important change is being made here in A-HOHFELD (language and logic), and it seems an appropriate occasion to rename both so that their names indicate more clearly what the language and logic are about. The important change in the A-HOHFELD Language and Logic that accompanies their changes in names to LRL and LLR has to do with two of their most important definitions: the definition of POWER and the definition of CONDITIONAL LEGAL RELATION. (All definitions in LRL are written in upper-case letters.) In the case of both definitions, the change is to make explicit what was left implicit in the former definitions, namely that both are based upon a jurisprudence of legal realism.¹ This is

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¹ The impetus for explicitly linking LEGAL RELATIONS to the legal system arose from post midnight discussions of the senior author of this article with Andrew J. I. Jones and Marek Sergot at the 1995 International Conference on Artificial Intelligence and Law in College Park, Md., about a

expressed in the new definitions by explicitly attributing the decisions about the legal characterization of events to the legal system. In the definition of POWER it is the decision by the legal system about what actions of a POWER-holder will be characterized as exercise of the POWER. In the definition of CONDITIONAL LEGAL RELATION (CLR), it is the decision by the legal system about what events will fulfill the condition of a CLR to bring about the underlying LEGAL RELATION. The changes in these two definitions are the same: adding language to indicate that these legal characterizations are being DONE-BY the legal system (in notation: D2(..., LS)). To the IF-statement characterizations that appear in the definitions of POWER and CONDITIONAL LEGAL RELATION in LRL (and in the underlying logic), 'D2(..., LS)' is added to indicate that the characterizations are DONE-BY the legal system. These two new definitions included in LRL and LLR are specified in detail in the Appendix.

The extension of the application of LRL to deal with all legal arguments stems from the inspiration of Hohfeld's metaphor about his fundamental legal conceptions as the "lowest common denominators" of legal discourse. Once this objective is actually achieved with the formulation of LEGAL RELATIONS in LRL, one can discern the expressive range of such LEGAL RELATIONS as covering no less than all possible legal arguments. Not an

forthcoming article ("A Formal Characterization of Institutional Power") in which they were defining "power" in a manner that recognizes explicitly the role of the legal system in determining whether the power has been "exercised". Until that discussion, the relationship of the exercise of a POWER (and more generally, the fulfillment of a condition of a CONDITIONAL LEGAL RELATION) to the legal system had been left implicit in the thinking and writings of the senior author of this article. The earlier implicit connection was made in terms of regarding statements like:

Person-x has a DUTY to person-y
to see to it that the lawn is mowed.

as merely being a short-hand way of describing what would happen in the legal system if x failed to see to it that the lawn was mowed, i.e.:

IF x violates her DUTY, i.e., fails to see to it that
the lawn is mowed,

THEN IF y litigates, i.e., seeks remedy in court,
THEN the court will indulge y's claim by
providing y a remedy with respect to x.

However, we concur with Jones and Sergot that more explicit recognition of the relationship to the legal system is appropriate in the very definition of POWER. Further, we would extend this explicit recognition to the definition also of CONDITIONAL LEGAL RELATION. See the definitions of POWER and CONDITIONAL LEGAL RELATION in the Appendix.

exactly modest claim, to be sure, but one whose justifiability can only be adequately appraised by those who become fluent in LRL -- which gets to what the bulk of this article is about, namely: puzzles and games for becoming fluent in the use of LRL in making legal arguments. In light of current enthusiasm for use of nonmonotonic logics as a vehicle for reasoning in legal argumentation, it is perhaps worth noting that to the extent that this claim about the universality of LRL as a language for representing legal argument is so, it demonstrates the feasibility of reasoning in legal argumentation that is done entirely in a logic (LLR) that is monotonic. While this says nothing about the relative desirability of using monotonic or nonmonotonic logic for reasoning in (or analysis of) legal argumentation (That is a debate looming on the horizon for a later time.), it surely puts to rest any suggestions about the exclusivity of nonmonotonic logics as the only way to do legal reasoning [Gardenfors & Makinson 1994, Sartor 1991, Gordon 1994, 1995, Horty 1994, Loui 1997, Prakken 1995]

2. Legal Arguments -- LEGAL RELATIONS Language and Logic

The essence of all arguments is assuming premisses, and then making inferences from them by agreed upon modes of reasoning. Legal arguments are of this pattern. The arguments in LRL are more explicit in setting forth the specific rules of inference of the underlying logic used in the reasoning. Before getting into example arguments, puzzles, and games, the rules of inference used in their reasoning are presented first.

A. Some Rules of Inference of the Logic of LEGAL RELATIONS

In the basis of the Logic of LEGAL RELATIONS there are six rules of inference assumed that are used in the examples of LRL legal arguments, puzzles and games presented here. For each rule below there is given:

- (1) the name of the rule
- (2) an explanation of the name
- (3) statement of the rule in notation
- (4) statement of the rule in text.

D2o: The out-rule for the DONE-BY operator
D2(s,p) \longrightarrow s
From "The state-of-affairs-s is brought about by (DONE-BY) person-p", it is valid to infer "The state-of-affairs-s is so".

IFo: The out-rule for the IF operator
IF(r,s), r \longrightarrow s
From "IF the state-of-affairs-r is so, the state-of-affairs-s is

so" and "The state-of-affairs-r is so", it is valid to infer "The state-of-affairs-s is so".

D2IFD2..D2oD2oD2i: The out-out-in-rule for the DONE-BY legal system operator $D2(IF(D2(s,p),D2(x,p)),LS), D2(s,p) \rightarrow D2(x,p)$
 From "the determination by (i.e., DONE-BY) the legal system that IF the state-of-affairs-s is DONE-BY Person-p, THEN Person-p exercises her POWER (exercise-x of her POWER is DONE-BY Person-p)" and "the state-of-affairs-s is DONE-BY Person-p", it is valid to infer "Person-p exercises her POWER".

D2IFo: The out-rule for the DONE-BY legal system operator

$D2(IF(s,c),LS), s \rightarrow c$
 From "the determination by (i.e., DONE-BY) the legal system that IF the state-of-affairs-s is so, THEN condition-c is fulfilled" and "the state-of-affairs-s is so", it is valid to infer "the condition-c is fulfilled".

POWERoD2oLRi: The out-out-in-rule for the exercise of a POWER (POWERout, D2out, some LEGAL RELATIONin)

$POWER(D2(x,p),LR), D2(x,p) \rightarrow LR$
 From "Person-p has the POWER to create LEGAL RELATION-LR by exercising that POWER" and "Person-p exercises that POWER (exercise-x of that POWER is DONE-BY Person-p)", it is valid to infer "The LEGAL RELATION-LR is so".

CONDITIONALo: The out-rule for the CONDITIONAL operator

$CONDITIONAL(c,LR), c \rightarrow LR$
 From "The CONDITIONAL (upon fulfillment of condition-c) LEGAL RELATION-LR is so" and "The condition-c has been fulfilled, i.e., c is so", it is valid to infer "LEGAL RELATION-LR is so".

B. A Simple Example of an Argument in LRL

A simple example of the kind of legal argument in ordinary language that could be made in LRL is the following that might be made by a disgruntled purchaser of a watch with a five-year battery-replacement guarantee whose battery had worn out in less than two years: "Mr. Jeweler, you offered to sell me this watch with a five-year battery-replacement guarantee for \$950, and I accepted your offer. Now, it is less than two years, and the battery is shot. I want it replaced." In case of a dispute, an argument about the transaction justifying Jeweler's DUTY to Purchaser to replace the battery (DUTY(r,p,j)) could be expressed in LRL in the terms set forth in Table 1.

Table 1. Argument in LRL for Seller's DUTY to Purchaser to replace battery

In Notation	In Text
1. POWER (D2(x1,j), POWER (D2(x5,p), DUTY(r,p,j)))	Jeweler-j has POWER to create a POWER of Purchaser-p to create a DUTY of Jeweler-j to Purchaser-p to replace-r batteries in purchased watch that wore out in less than five years. (Legal Premiss)
2. D2(d,j)	The display of the watch in her shop with a tag indicating the five-year battery-replacement guarantee and price of \$950 was DONE-BY (D2) Jeweler-j. (Factual Premiss)
3. D2(IF (D2(d,j), D2(x1,j)),LS)	Determining that the display of the watch and tag being DONE-BY Jeweler-j is an exercise of Jeweler-j's POWER(1), is DONE-BY the legal system (LS). (Legal Premiss)
4. D2(x1,j)	The exercise of her POWER(1) is DONE-BY Jeweler-j. Step 4 can be deduced from Steps 3 and 2 by the assumed rule of inference, D2IFD2..D2oD2oD2i.
5. POWER (D2(x5,p), DUTY(r,p,j))	Purchaser-p has POWER of acceptance to create the DUTY of Jeweler-j to Purchaser-p to replace the battery in purchased watch that wears out in less than five years. Step 5 can be deduced from Steps 1 and 4 by the assumed rule of inference, POWERoD2oLRi.
6. D2(b,p)	The buying of the displayed watch was DONE-BY Purchaser-p. (Factual Premiss)
7. D2 (IF(D2(b,p), D2(x5,p)), LS)	Determining that the buying the displayed watch being DONE-BY Purchaser-p is an exercise of Purchaser-p's POWER(5), is DONE-BY the legal system (LS). (Legal Premiss)
8. D2(x5,p)	The exercise of POWER(5) is DONE-BY Purchaser-p. Step 8 can be deduced from Steps 7 and 6 by the assumed rule of inference, D2IFD2..D2oD2oD2i.
9. DUTY(r,p,j)	Jeweler-j has a DUTY to Purchaser-p to replace the worn-out battery in the watch. Step 9 can be deduced from Steps 5 and 8 by the assumed rule of inference, POWERoD2oLRi.

In the LRL argument above Steps 4, 5, 8, and 9 are deductions made using the D2IFD2..D2oD2oD2i and POWERoD2oLRi rules of inference of the Logic of LEGAL RELATIONS (see Section 2A above), while the other steps are premisses. Step 1 is a premiss about an

existing legal state of affairs, Steps 2 and 6 are premisses about something that was done by legal persons, and Steps 3 and 7 are premisses about how the legal system responds in legally characterizing events that occur in the current legal state of affairs. Each of these premisses is, of course, open to challenge by introduction of evidence or further argument that something otherwise is so.

For even such a simple transaction as buying a watch with a battery-replacement guarantee, the need for fluency in LRL is vividly demonstrated for an analyst to be able to construct a single-step-at-a-time argument about it in LRL. Such single-step arguments, of course, facilitate the searches of those who are seeking to spot the weakest links in the chain of argument (in LRL, and through it, in the customary doctrinal language of law).

With this brief example of the reasoning and kinds of legal argument being considered in LRL and some of the rules of inference in its logic, we are ready to turn to consideration of puzzles and games for use in achieving fluency in LRL.

3. Puzzles and Games for Fluency in LRL

The LRL puzzles, called Play-A-Round Puzzles, are simpler than the LRL games, because their rules are simpler. There are three different varieties of PLAY-A-Round Puzzles (Basic, Deontic, and "Wild Cards") and three different levels of play (Fundamental, Enriched, and More Enriched). Complexity increases with changes in variety and level; overall complexity with changes in variety and complexity of Deontic LEGAL RELATIONS with changes in level. The Basic puzzles and games deal with LEGAL RELATIONS alone, while the Deontic ones also involve the relationship of Deontic operators to the Deontic LEGAL RELATIONS, and the Wild Card games and puzzles introduce variables for the operators and operands of LEGAL RELATIONS. At the Fundamental level, the games and puzzles deal only with the Deontic LEGAL RELATIONS that evolved from Hohfeld's fundamental legal conceptions; at the Enriched level, additional RIGHTS, DUTIES, PRIVILEGES, and NO-RIGHTS are introduced; and at the More Enriched level, still more of different Deontic LEGAL RELATIONS are added.

Three ideas are common to both the LRL puzzles and games; they are: Resources, Goal, and Solution.

A. LRL Play-A-Round Puzzles

1. Resources

The Resources for LRL Play-A-Round Puzzles (and LRL games, as well) are sets of alpha-numeric characters used as parts of statements of notational abbreviations (operator parts and operand parts) of LEGAL RELATIONS in LRL. The Resources for puzzles at the Fundamental level are listed in Table 2.

Table 2. Resources for LRL Play-A-Round Puzzles and LRL Games

Kinds: Statements/ Variables	Operator Parts	Operand Parts
1. Deontic LEGAL RELATIONS	RIGHT DUTY NO-RIGHT PRIVILEGE	p1 p2 p3 p4 (persons) s1 s2 s3 s4 (states-of-affairs)
2. Capacitive LEGAL RELATIONS	POWER LIABILITY DISABILITY IMMUNITY	p1 p2 p3 p4 s1 s2 s3 s4 x1 x2 (POWER exercises)
3. CONDITIONAL LEGAL RELATIONS	CONDITIONAL	c1 c2 c3 (conditions)
4. Other Statements	IF D2 (DONE-BY)	c1 c2 c3 p1 p2 p3 p4 s1 s2 s3 s4 LS (Legal System)
5. All Statements	NEG (negation)	(any statement)
6. Deontic LEGAL RELATIONS	O (obligation) D4 (DONE-FOR)	D2 D4 p1 p2 p3 p4 s1 s2 s3 s4
7. "Wild cards" (variables)	LR (LEGAL RELATIONS) D W x p c s	

The Resources in Rows 1-5 are used in the Basic variety of LRL Play-A-Round puzzles; those in Row 6 are added in the Deontic variety; and the Resources in all 7 rows are used in the "Wild Cards" variety of LRL Play-A-Round. Some Resources will be used in the puzzles to specify the Goal.

2. Goal

The Goal in the Basic variety of LRL Play-A-Round puzzle is a notational statement constructed from four to six Resources that expresses a Deontic LEGAL RELATION

about the DUTY of one person to another person to see to it that some state of affairs is so. Such a puzzle's Goal will be one of the following four statements, each of which is logically equivalent to each of the others:

- DUTY(s,pi,pj)
- Person-pj has a DUTY to person-pi to do s.
- RIGHT(s,pj,pi)
- Person-pi has a RIGHT that person-pj do s.
- NEG(PRIVILEGE(NEG(s),pi,pj))
- IT IS NOT SO THAT person-pj has a PRIVILEGE with respect to person-pi to do NOT s.
- NEG(NO-RIGHT(s,pj,pi))
- IT IS NOT SO THAT
- person-pi has a NO-RIGHT that person-pj do s.
- where i and j are different numerals from 1 to 4, and s is accompanied by any numeral from 1 to 4.

In the Deontic variety of Play-A-Round puzzles a fifth equivalent expression of a Deontic LEGAL RELATION is possible, namely:

- O(D2(D4(s,pi),pj))
 - IT IS OBLIGATORY THAT
 - (s be DONE-FOR person-pi) be DONE-BY person-pj.
- In this more complex variety of puzzle, participants get involved in relating the Deontic LEGAL RELATIONS to their underlying concepts, both Deontic (OBLIGATION) and action (DONE-BY and DONE-FOR).² These five equivalent statements of UNCONDITIONAL LEGAL RELATIONS are different ways of expressing the claim of plaintiffs in upwards of 99 percent of the disputes reported in appellate court opinions (authors' estimate); so, the puzzles (and games) mirror legal reality in this respect.

It is only after the Goal has been set that one can construct Solutions from the remaining Resources, because Solutions are defined (in part) in terms of the Goal.

3. Solutions

In LRL Play-A-Round puzzles the task is to find all of the different Solutions that can be constructed from the remaining Resources after the Goal has been set. A Solution is any set of premisses that can be constructed

² The D2 (DONE-BY) relation is the converse of the STIT (seeing to it that) relation of current frontier work among logicians who are formulating logics of action. The efforts to date have focused upon the equivalent of D2, and relatively little has been done on D4. See Horty & Belnap[1995] and references therein. However, the seminal work of Herrestad & Krogh with indexed deontic operators offers an alternative approach for achieving the same effects as the D4 relation. See Herrestad & Krogh [1995].

from the remaining Resources which is such that the Goal can be deduced from those premisses by means of the six rules of inference of LLR specified above in Section 2A and the five logical equivalencies listed in the immediately preceding Section 3A2. One Solution will be different from another for purposes of the puzzles and games if and only a different set of Resources is used in constructing its premisses.

The relationship between these three fundamental ideas of LRL puzzles and games (Resources, Goal, and Solutions) can, perhaps, be seen more clearly by way of a sample Play-A-Round puzzle.

4. A Sample FD (Fundamental Deontic) Play-A-Round Puzzle: Play-A-Round FD1

Goal: DUTY(s1,p1,p2)

Resources:

DUTY NO-RIGHT PRIVILEGE IMMUNITY POWER
 CONDITIONAL CONDITIONAL IF IF NEG NEG
 D2 D2 D2 D2 D2 D2 D2 D2 D2 D2 D2 D2 D4
 O O LS LS LS x1 x1 x1 x2 c1 c1 c2 c2 c3
s1 s1 s1 s2 s3 s3 s3 s4
p1 p1 p2 p2 p3 p3 p3 p3 p4 p4 p4
 (The four underlined Resources are those used in setting the Goal. They are no longer available as part of the 53 remaining Resources for constructing Solutions.)

At the first level for the Goal of DUTY(s1,p1,p2) with the indicated 53 remaining Resources, there are two kinds of Solutions to PAR-FD1: Basic and Deontic. There are two Basic solutions:

1. NEG(NO-RIGHT(s1,p2,p1)) and
2. NEG(PRIVILEGE(NEG(s1),p1,p2))

and one Deontic:

3. O(D2(D4(s1,p1),p2)).

As indicated by these three Solutions, all first-level Solutions consist of one premiss only.

There are two kinds of second-level Solutions:

- (1) POWER ... and POWER-equivalent ... Solutions and
- (2) CONDITIONAL ... Solutions.

Each second-level Solution has three premisses. There are five second-level POWER ... and POWER-equivalent ... Solutions to PAR-FD1, each of which uses 21 to 23 Resources; they are the following:

4. POWER(D2(x1,p3),NEG(NO-RIGHT(s1,p2,p1))), D2(s3,p3), D2(IF(D2(s3,p3)D2(x1,p3)),LS)
5. NEG(IMMUNITY (NEG(NO-RIGHT(s1,p2,p1)),D2(x1,p3))), D2(s3,p3), D2(IF(D2(s3,p3)D2(x1,p3)),LS)
6. POWER(D2(x1,p3),NEG(PRIVILEGE

- (NEG(s1,p1,p2))), D2(s3,p3),
D2(IF(D2(s3,p3),D2(x1,p3)),LS)
7. POWER(D2(x1,p3),O(D2(D4(s1,p1),p2))),
D2(s3,p3), D2(IF(D2(s3,p3),D2(x1,p3)),LS)
 8. NEG(IMMUNITY
(O(D2(D4(s1,p1),p2)),D2(x1,p3))), D2(s3,p3),
D2(IF(D2(s3,p3),D2(x1,p3)),LS)

There are six second-level CONDITIONAL ... Solutions of PAR-FD1, each of which uses 13 or 14 Resources; they are the following:

9. CONDITIONAL
(c1,NEG(NO-RIGHT(s1,p2,p1))), s3,
D2(IF(s3,c1),LS)
10. CONDITIONAL
(c2,NEG(NO-RIGHT(s1,p2,p1))), s3,
D2(IF(s3,c2),LS)
11. CONDITIONAL
(c1,NEG(PRIVILEGE(NEG(s1),p1,p2))), s3,
D2(IF(s3,c1),LS)
12. CONDITIONAL
(c2,NEG(PRIVILEGE(NEG(s1),p1,p2))), s3,
D2(IF(s3,c2),LS)
13. CONDITIONAL(c1,O(D2(D4(s1,p1),p2))), s3,
D2(IF(s3,c1),LS)
14. CONDITIONAL(c2,O(D2(D4(s1,p1),p2))), s3,
D2(IF(s3,c2),LS)

There are four kinds of third-level Solutions: POWER-POWER ..., POWER-CONDITIONAL ..., CONDITIONAL-POWER ..., and CONDITIONAL-CONDITIONAL Solutions, each of which has five premisses. There are eight kinds of fourth-level solutions (with seven premisses), 16 kinds of fifth-level (with nine premisses), ... 2^n kinds of the n th level Solutions (with $2n-1$ premisses). However, there are insufficient remaining Resources to construct Solutions beyond the second level for PAR-FD1. So, there are a total of the 14 different Solutions listed above to the Goal of PAR-FD1, i.e., 14 different sets of premisses can be constructed from the remaining Resources such that from each set, DUTY(s1,p1,p2) can be deduced by means of the inference rules and equivalencies of LLR. However, if an s3 Resource is added to the present set of 53 remaining Resources to create a different puzzle, PAR-FD1', the following third level Solution becomes possible along with 62 other Solutions at that level:

15. CONDITIONAL(c2,POWER
(D2(x1,p3),NEG(NO-RIGHT(s1,p2,p1))),
D2(s3,p3), D2(IF(D2(s3,p3),D2(x1,p3)),LS), s4,
D2(IF(s4,c2),LS)

So, the addition of one more appropriate remaining Resource explodes the 14-Solution PAR-FD1 to a variant of the puzzle that has 77 different Solutions.

As implemented at <http://thinkers.law.umich.edu> in the THINKERS ALLIANCE on the Internet, the LRL Play-A-Round Puzzles are accompanied by an experimental laboratory in which participants who are seeking to find all possible arguments for a given puzzle can conduct experiments to gain additional information about the missing Resources in their missing Solutions. This concludes the discussion of puzzles; next on the agenda are LRL games.

B. LRL Games: (1) Clever Plaintiff and (2) Legal Argument

There are two different kinds of LRL games, each of which is like the LRL puzzles with the same three varieties and at three different levels: Clever Plaintiff games and Legal Argument games. The mental activities that players of these games engage in the course of play include (1) the formulation of premisses from the alphabet of resources that are generated for each match from which the plaintiff's claim can be inferred by (2) arguments constructed using (3) specified inference rules in such a way that (4) all essential resources are used, no forbidden resources are used, and (possibly) some permitted resources are used.

1. The Clever Plaintiff Games

The Clever Plaintiff games are similar to WFF 'N PROOF: The Game of Modern Logic [Allen, 1961]. One player (Plaintiff) sets a Goal from the available Resources, and then takes turns with the other player (Defendant) moving pairs of the remaining Resources into Forbidden, Permitted, and Essential categories, imposing those constraints upon use of those Resources in building Solutions. As in the LRL Play-A-Round Puzzles, the Goal will be some DUTY or DUTY-equivalent expression.

Generally, in moving each player is in the role of Plaintiff seeking to get to the Solution that she has in mind without making any flubs by her moves (where flubs are false claims by the mover about (a) the move not making achievement of a Solution too easy (A-flubs), or about (b) the move not making achievement of all Solutions too hard (P-flubs), or about (c) the move being made where a correct challenge could have been made by the mover of the previous move because it was a flub (CA-flubs)). But extra-clever players may trap others with deliberate flubs by subtly making some Solution too easy in a way that they diagnose other players will miss. Players continue making moves until one challenges a move of the other or the remaining Resources are exhausted. At that point (a) one or both parties will have the burden of proving that there still is a Solution possible from the Resources available under

the constraints imposed by the transfer to the various categories, and (b) who wins (and the scoring) is determined by whether that/those burden/s of proof is/are sustained.

The complete set of game rules that define the Clever Plaintiff Games are presented at the same Internet site as the LRL Play-A-Round Puzzles:

<http://thinkers.law.umich.edu> . There are also included there some sample completed matches along with sets of Resources for use in practice play.

In the Clever Plaintiff Games both parties play as Plaintiffs. They each seek the same Goal and to position themselves advantageously with respect to the other player on the burden of proof. In the Legal Argument Games the parties are different; Plaintiff and Defendant seek different postures with respect to different Goals.

2. The Legal Argument Games

The Legal Argument Games are similar to Clever Plaintiff Games in some ways, but differ drastically in style of play because of different Goals being sought by the players in the Legal Argument Games. In these Plaintiff is still seeking the Goal set by Plaintiff at the outset, but Defendant has dual objectives that are different. Defendant can win (1) by preventing Plaintiff from ever achieving a Solution until the Resources have all been played, or (2) by achieving a Goal herself that is the negation of the Goal set by Plaintiff.

The move options are also different in the two kinds of games. In Clever Plaintiff each party transfers up to two of the remaining Resources to the Forbidden, Permitted, or Essential categories on each turn. In Legal Argument Games Defendant transfers three Resources each turn, and Plaintiff transfers five (or the equivalent of five transfers in combinations of shifts and transfers, where 1-shift = 2-transfers). On his turn Plaintiff can substitute shifts of a Resource among the categories for transfers from the remaining Resources to the categories.

As in Clever Plaintiff, parties continue to take turns making moves until one party challenges or the remaining Resources are all transferred to the categories, at which point one of the parties has the burden of proving that a Solution is possible. If Resources are all transferred, Plaintiff has the burden of proving that the Goal set can be achieved using the available Resources under the constraints imposed by transfers to the various categories. If an A-flub or CA-flub challenge is made, the challenger will have the burden of proving (a) on A-flub challenges,

that the other party's last move allows the challenger to achieve her Goal (for Defendants, negation of the Goal set) on her next move, and (b) on CA-flub challenges, that some prior move was an A-flub.

Similar to the other puzzles and games, the complete set of game rules for the Legal Argument Games, as well as some example completed matches and sets of Resources for use in practice play are presented at the same Internet site as the LRL Play-A-Round Puzzles:

<http://thinkers.law.umich.edu> .

4. Conclusion

A total of 27 puzzles and games for becoming fluent in the LEGAL RELATIONS Language is briefly summarized here with more complete details available at the THINKERS ALLIANCE site on the Internet. As increasing numbers of workers in the legal domain become fluent in this comprehensive and precisely-defined language, the effects upon legal discourse and legal literature will unfold in step with the increasing fluency. The means for accelerating how to become more fluent is now available. The stimulation of the motivation of law students, practicing lawyers, rules drafters, judges, legal scholars, and other toilers in the legal vineyards to achieve such fluency will evolve as more examples of the usefulness of LRL are made public:

- For law students, pictorial representations of LRL analysis of appellate court opinions to deepen understanding
- For practicing lawyers, more comprehensive and precise tools for structurally interpreting important legal documents, such as their own professional liability insurance policies
- For rules drafters, a means of checking the ambiguity in the logical structure of regulations, statutes, constitutions, corporate by-laws, contracts, and other sets of legal rules to assure that such ambiguity is deliberate, rather than inadvertent
- For appellate court judges, to craft written opinions that precisely express the structure, scope, and limits of their decisions
- For legal scholars, a tool for the more precise and comprehensive analysis and expression of legal doctrine for benefit of students and others
- Finally, for those other toilers who are seeking to build computer systems to assist the legal profession, a representation language for expert and other systems whose expressive power covers all of legal discourse.

But then, one must wonder: whose crystal ball is sufficiently uncloudy to permit confident prediction about what languages in an ever-more-technological 21st Century

will pass muster in the legal domain -- much less which shall prove most useful -- for the analysis of legal problems and communication about them? LRL is our candidate. So, now is the time for those in law who are inclined to agree to start to play and solve and learn!

References

- Allen, Layman E. [1996] "From the Fundamental Legal Conceptions of Hohfeld to LEGAL RELATIONS: Refining the Enrichment of Solely Deontic LEGAL RELATIONS", pp. 1-26 in DEONTIC LOGIC, AGENCY AND NORMATIVE SYSTEMS, (Edited by Mark A. Brown and Jose Carmo), Springer and the British Computer Society, 1996. Presented at DEON '96: Third International Workshop on Deontic Logic in Computer Science, Sesimbra, Portugal, 11-13, January 1996. (Volume in the WORKSHOPS IN COMPUTING Series edited by C. J. van Rijsbergen).
- [1995] "Enriching the Deontic Fundamental Legal Conceptions of Hohfeld", Invited paper presented at the 25th Anniversary Celebration of the Norwegian Research Center for Computers and Law, March 15-17, 1995, Oslo University, Oslo, Norway, to be published in Anniversary Anthology in Computers and Law, Edited by Jon Bing & O. Torvund, TANO-publ., Oslo.
- [1983] "Two Modes of Representing Sets of Legal Norms: Normalization and an Arithmetic Model", pp. 16.1 - 16.61. Proceedings of the Third International Congress of the Supreme Court of Italy Center for Electronic Documentation, JURIDICAL INFORMATICS AND THE NATIONAL AND INTERNATIONAL COMMUNITY, Rome, May 9-14, 1983.
- [1982] "Towards a Normalized Language to Clarify the Structure of Legal discourse", Proceedings of International Study congress on LOGICA, INFORMATICA, DIRRETO, Florence, Italy, April 6-10, 1981. Published in DEONTIC LOGIC, COMPUTATIONAL LINGUISTICS AND LEGAL INFORMATION SYSTEMS, pp. 349-407, Edited by Antonio A. Martino, North-Holland, Amsterdam.
- [1974] "Formalizing Hohfeldian Analysis to Clarify the Multiple Senses of 'Legal Right': A Powerful Lens for the Electronic Age", 48 Southern California Law Review 428-487.
- [1968] "A Language-Normalization Approach to Information Retrieval in Law", 9 Jurimetrics Journal 1.
- [1961] WFF 'N PROOF: The Game of Modern Logic, Autotelic Instructional Materials Publishers, Turtle Creek, Pa.
- [1957] "Symbolic Logic: A Razor-Edged Tool for Drafting and Interpreting Legal Documents", 66 Yale Law Journal 833.
- Allen, Layman E. & Saxon, Charles S. [1995] "Better Language, Better Thought, Better Communication: The A-HOHFELD Language for Legal Analysis", Proceedings of the Fifth International Conference on Artificial Intelligence and Law, May 21-24, 1995, University of Maryland, College Park, Md.
- [1994] "Controlling Inadvertent Ambiguity in the Logical Structure of Legal Drafting by Means of the Prescribed Definitions of the A-Hohfeld Structural Language", 9 THEORIA 135-172. Invited paper for the Conference in Celebration of the 25th Anniversary of the Istituto per la documentazione giuridica of the Consiglio Nazionale delle Ricerche, TOWARD A GLOBAL EXPERT SYSTEM IN LAW: Selected Examples from Health and Environmental Law, Florence, Italy, December 1-3, 1993.
- [1993] "A-Hohfeld: A Language for Robust Structural Representation of Knowledge in the Legal Domain to Build Interpretation-Assistance Expert Systems", 205-224, in Deontic Logic in Computer Science: Normative System Specification, Edited by John-Jules Ch. Meyer and Roel J. Wieringa, John Wiley & Sons, New York.
- [1991a] "More IA Needed in AI: Interpretation Assistance for Coping with the Problem of Multiple Structural Interpretations", presented at the Third International Conference on Artificial Intelligence and Law, June 25-28, 1991, St. Catherine's College, Oxford, England and published in the Proceedings of the Conference by the Association for Computing Machinery (ACM).
- [1991b] "A-Hohfeld: A Language for Robust Structural Representation of Knowledge in the Legal Domain to Build Interpretation-Assistance Expert Systems", Invited paper for the First International Workshop on DEONTIC LOGIC IN COMPUTER SCIENCE, Amsterdam, The Netherlands, December 11-13, 1991, published in DEONTIC LOGIC IN COMPUTER SCIENCE: Normative System Specification (Edited by John-Jules Ch. Meyer and Roel J. Wieringa, John Wiley & Sons, pp. 205-224 (1993).
- [1986] "Analysis of the Logical Structure of Legal Rules by a Modernized and Formalized Version of Hohfeld's Fundamental Legal conceptions", 385-450, in Automated Analysis of Legal Texts: Logic, Informatics, Law, Edited by Antonio A. Martino and Fiorenza Socci Natali, North-Holland, Amsterdam.
- Gardenfors, Peter and Makinson, David, [1994] "Nonmonotonic inference based on expectations", 65 ARTIFICIAL INTELLIGENCE 197-245 (January 1994).
- Gordon, Thomas F. [1995] The pleadings game : an artificial intelligence model of procedural justice, Dordrecht Boston : Kluwer Academic Publishers, 1995.
- [1994] "The Pleadings Game: An Exercise in Computational Dialectics", 2 ARTIFICIAL INTELLIGENCE AND LAW 239-292.
- Herrestad, Henning & Krogh, Christen [1995] "Obligations Directed from Bearers to Counterparties" in The Fifth International Conference on Artificial Intelligence and Law -- Proceedings of the Conference. ACM Press, New York, 1995.
- Hohfeld, Wesley N. [1913] "Fundamental Legal Conceptions as Applied in Judicial Reasoning," 23 YALE L. J. 16 (1913). Reprinted with a New Foreword by Arthur L. Corbin by Yale University Press, London & New Haven (1964).
- Jones, Andrew J. I. & Sergot, Marik [1997] "A Formal Characterization of Institutional Power" (Forthcoming)
- Horty, John F. & Belnap, Nuel [1995] "The Deliberative STIT: S Study of Action, Omission, Ability, and Obligation, 24 J. OF PHILOSOPHICAL LOGIC 583-644.
- [1994] "Moral Dilemmas and Nonmonotonic Logic", 23 J. OF PHILOSOPHICAL LOGIC 35-65 (1994).
- Loui, Ron [1997] "Alchouron and von Wright on conflict among norms", in Defeasible Deontic Logic: Essays in Nonmonotonic Normative Reasoning (edited by Donald Nute), Kluwer Academic Publishers, Dordrecht, Holland (in press).
- Prakken, Henry [1995] "From logic to dialectics in legal argument", Proceedings of the Fifth International Conference on Artificial Intelligence and Law, Washington DC, ACM Press, 165-174, 1995.

Sartor, Giovanni [1991]"The Structure of Norm Conditions and Nonmonotonic Reasoning in Law", in Proceedings of the Third International Conference on Artificial Intelligence and Law, ACM Press, 155-164.

Appendix

Operationally, the changes in the definitions of POWER and CONDITIONAL LEGAL RELATION in LRL and its underlying logic amount to adding 'D2 ... LS' to the IF-statement characterizations in the underlying logic (and corresponding language in LRL) to indicate that the characterizations are DONE-BY the legal system. The additions to the A-HOHFELD definitions to produce the new definitions of LRL are indicated by brackets below:

Definition of "POWER" (in Logic of LEGAL RELATIONS)

POWER(D2(x,p)(t2),LR(t2))(t1) =df
 K....N(LR)(t1)....SsKK...B(D2(s(t2),p)(t1)
 ...[D2](I D2(s,p)(t2) D2(x,p)(t2),[LS])
 ...I..D2(x,p)(t2)
 .. K.LR(t2)
 ..N(POWER(D2(x,p)(t3),LR(t3))(t2))

'Person-p has POWER at time-t1 to create LEGAL-RELATION -LR at time-t2 by something being DONE-BY person-p at time-t2 that will be legally characterized as an exercise-x of that POWER' is equal to by definition

- '1. LEGAL-RELATION-LR is NOT so at time-t1, AND
 2. there is a state-of-affairs-s such that
 A. it is naturally possible at time-t1 that state-of-affairs-s be DONE-BY person-p at time-t2, AND
 B. [the following is determined (DONE-BY) the legal system:]
 IF 1. state-of-affairs-s is DONE-BY person-p at time-t2,
 THEN 2. exercise-x (of p's POWER) is DONE-BY person-p at time-t2, AND
 C. IF 1. exercise-x (of p's POWER) is DONE-BY person-p at time-t2,
 THEN 2. LEGAL-RELATION-LR is created at time-t2, AND
 3. IT IS NOT SO THAT person-p has POWER at time-t2 to create the LEGAL-RELATION -LR at time-t3 by doing something that will be legally characterized as exercise-x at time-t3 (of the POWER involved, if there were such POWER), that is: person-p has DISABILITY at time-t2 to create the LEGAL-RELATION-LR at time-t3 by doing something that will be legally characterized as an exercise-x at time-t3 of the POWER that is the negation of such DISABILITY'.

The corresponding definition in the LEGAL RELATIONS Language, simplified by omission of the time references and expressed in language more attuned to the legal profession, is as follows.

Contextual Definition of "POWER" (in LEGAL RELATIONS Language)

"Person-p has POWER to create LEGAL RELATION-LR."
 means

1. LEGAL RELATION-LR is NOT so, AND
2. there is some state-of-affairs-s such that,
 - A. IF state-of-affairs-s is DONE-BY person-p,
 THEN the legal system-LS will treat that as an exercise-x of POWER DONE-BY person-p to create LEGAL RELATION- LR, AND
 - B. it is naturally possible for state-of-affairs-s to be DONE-BY person-p, AND
 - C. IF state-of-affairs-s is DONE-BY person-p
 THEN LEGAL RELATION-LR is created".

In notation: "POWER(D2(x,p),LR)" means "NEG(LR) & Ss ((D2(IF(D2(s,p),D2(x,p)),LS)) & B(D2(s,p)) & IF(D2(s,p),LR))".

Thus, the following is so:

- IF 1. person-p has POWER to create LEGAL RELATION-LR, AND
 2. state-of-affairs-s is DONE-BY person-p, AND
 3. state-of-affairs-s being DONE-BY person-p is treated by the legal system to be an exercise of her POWER to create LEGAL RELATION-LR being DONE-BY person-p,
 THEN 4. person-p has exercised her POWER to create LEGAL RELATION-LR, AND
 5. LEGAL RELATION-LR is created.

In notation: IF POWER(D2(x,p), LR) & D2(s,p) & D2(IF(D2(s,p),D2(x,p)),LS)
 THEN D2(x,p) & LR.

Definition of "CONDITIONAL LEGAL RELATION" (in Logic of LEGAL RELATIONS)

CLR(c(t2),LR(t2))(t1) =df K....NLR(t1)
SsKK...B(s(t2)(t1)
 ...[D2](I.s(t2).c(t2),[LS])
 ...I..c(t2)
 ..K.LR(t2)
 ..NCLR(c(t3),LR(t3))(t2)

There is a CONDITIONAL-LEGAL-RELATION-CLR at time-t1 that LEGAL-RELATION-LR will be created at time-t2 by the fulfillment of condition-c at time-t2'

is equal to by definition

- '1. LEGAL-RELATION-LR is NOT so at time-t1, AND
2. there is an state-of-affairs-s such that
 - A. it is naturally possible at time-t1 for state-of-affairs-s to occur at time-t2, AND
 - B. [the following is determined (DONE-BY) the legal system:]
 - IF 1. state-of-affairs-s occurs at time-t2,
 - THEN 2. condition-c is fulfilled at time-t2, AND
 - C. IF 1. condition-c is fulfilled at time-t2,
 - THEN 2. LEGAL-RELATION-LR is created at time-t2, AND
 3. CONDITIONAL-LEGAL-RELATION-CLR is NOT so at time-t2 that LEGAL-RELATION-LR will be created at time-t3 by the fulfillment of condition-c at time-t3'.

The corresponding definition in LRL, simplified by omission of the time references and expressed in language more attuned to the legal profession, is as follows.

Contextual Definition of "CONDITIONAL LEGAL RELATION" (in LRL)

"There is a CONDITIONAL-LEGAL-RELATION-CLR that LEGAL-RELATION-LR will be created by the fulfillment of condition-c." means

- "1. LEGAL RELATION-LR is NOT so, AND
2. there is an state-of-affairs-s that the legal system will treat as fulfilling condition-c, AND
3. it is naturally possible for state-of-affairs-s to occur, AND
4. IF A. state-of-affairs-s occurs,
THEN B. condition-c is treated by the legal system as fulfilled, AND
5. IF A. condition-c is fulfilled,
THEN B. LEGAL RELATION-LR is created."

In notation:

"CONDITIONAL(c,LR)" means "NEG(LR) & Ss(D2(IF(s,c),LS)) & B(s) & IF(s,D2(c,LS) & IF(c,LR))"

Thus, the following is so:

- IF 1. CONDITIONAL LEGAL RELATION-LR is so, AND
 2. state-of-affairs-s occurs, AND
 3. IF A. state-of-affairs-s occurs
THEN B. c is treated by the legal system to be fulfilled,
- THEN 4. c is fulfilled, AND
 5. LEGAL RELATION-LR is created.

In notation:

IF CONDITIONAL(c,LR) & s & D2(IF(s,c),LS)
THEN c & LR.