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Using argument schemes for hypothetical reasoning in law

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Abstract This paper studies the use of hypothetical and value-based reasoning in US Supreme-Court cases concerning the United States Fourth Amendment. Drawing upon formal AI & Law models of legal argument a semi-formal reconstruction is given of parts of the *Carney* case, which has been studied previously in AI & law research on case-based reasoning. As part of the reconstruction, a semi-formal proposal is made for extending the formal AI & Law models with forms of metalevel reasoning in several argument schemes. The result is compared with Rissland's (1989) analysis in terms of dimensions and Ashley's (2008) analysis in terms of his process model of legal argument with hypotheticals.

1 Introduction

Laws tend to be drafted in abstract terms intended to express the legislative will in a way which covers the widest possible range of situations. When the laws are applied, however, they must be interpreted in the light of specific situations. The gap is closed in a number of ways: Bench-Capon (1991) describes the process with respect to UK Social Security law. There the very general terms of primary legislation are made more specific using the intermediate concepts of secondary

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legislation, which are in turn clarified by case law, and then made operational through guidelines expressed in terms of observable facts ascertainable by those charged with applying the law. A similar process is found with respect to almost all laws. In this paper[1] we will consider how the gap is closed in the case of the United States Fourth Amendment. In particular, drawing on the work of Edwina Rissland (1989) and Kevin Ashley (2008), we will examine the role played by hypothetical and value-based reasoning in Supreme Court cases, with particular reference to the *Carney* case.[2] One important role of these hypotheticals is to examine and refine the tests which are proposed to make the law applicable to particular cases by identifying observable features which can provide sufficient (and perhaps necessary) conditions for the legal concepts.

Section 2 describes the legal background to *Carney* and summarises its previous discussion in AI & Law. Section 3 provides some formal background and Section 4 gives a semi-formal reconstruction of *Carney*. Section 5 provides a conclusion.

2 Legal background

The Fourth Amendment protects the

> right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures.

While this is perfectly clear—no unreasonable searches can be conducted—it offers little or no guidance as to what will be considered unreasonable. In practice this fundamental right is preserved by a requirement that searches be conducted only if a warrant issued by an independent judicial officer has first been obtained. This means that police officers must convince an independent judicial officer that the search is reasonable, and cannot simply act on their own belief that it is reasonable. But there are circumstances where it is impractical to obtain a warrant. One example is furnished by the *Carroll*[3] case. In that case, dating from the time of Prohibition, George Carroll and John Kiro were indicted and convicted for 'transporting in an automobile intoxicating spirituous liquor, to-wit: 68 quarts of so-called bonded whiskey and gin, in violation of the National Prohibition Act'. Carroll contended that the search of his Oldsmobile Roadster without a warrant infringed his privacy as protected by the Fourth Amendment. The Supreme Court upheld the reasonableness of the search. The opinion delivered by Taft, CJ, began by citing a number of statutes, dating back to 1799, which explicitly authorised warrantless search in the case of, for example customs officials who suspected concealed contraband:

[1] This paper is an extended and revised version of Bench-Capon and Prakken (2009).

[2] California v. Carney, 471 US 386 (1985).

[3] Carroll v. United States, 267 US 132 (1925).

> We have made a somewhat extended reference to these statutes to show that the guaranty of freedom from unreasonable searches and seizures by the Fourth Amendment has been construed, practically since the beginning of the Government, as recognizing a necessary difference between a search of a store, dwelling house or other structure in respect of which a proper official warrant readily may be obtained, and a search of a ship, motor boat, wagon or automobile, for contraband goods, where it is not practicable to secure a warrant because the vehicle can be quickly moved out of the locality or jurisdiction in which the warrant must be sought.

Although Taft was quite insistent that a search could be conducted without a warrant only where it is not practicable to secure a warrant, this case was used as the basis for the so called *Automobile Exception* to the Fourth Amendment. The status of this exception current at the time of the *Carney* case was expressed in Burger CJ's opinion in *South Dakota v. Opperman*:[4]

> The reason for this well settled distinction is twofold. First, the inherent mobility of automobiles creates circumstances of such exigency that, as a practical necessity, rigorous enforcement of the warrant requirement is impossible. *Carroll v. United States*, 267 US 132, 153–154 (1925); *Coolidge v. New Hampshire*, 403 US 443, 459–460 (1971). But the Court has also upheld warrantless searches where no immediate danger was presented that the car would be removed from the jurisdiction. *Chambers v. Maroney*, 399 US 42 (1970); *Cooper v. California*, 386 US 58 (1967). Besides the element of mobility, less rigorous warrant requirements govern because the expectation of privacy with respect to one's automobile is significantly less than that relating to one's home or office ... Automobiles, unlike homes, are subjected to pervasive and continuing governmental regulation and controls, including periodic inspection. As an everyday occurrence, police stop and examine vehicles when license plates or inspection stickers have expired, or if other violations, such as exhaust fumes or excessive noise, are noted, or if headlights or other safety equipment are not in proper working order.

Thus while exigency was crucial in *Carroll*, where the need to prevent loss of evidence was the motivation for allowing warrantless search, lowered expectations of privacy had by this time also taken on importance. Indeed exigency was no longer sufficient, as shown by, for example *Chadwick*,[5] in which it was held that a locked item of luggage (a footlocker) did require a warrant because

> The footlocker search was not justified under the "automobile exception," since a person's expectations of privacy in personal luggage are substantially greater than in an automobile. In this connection, the footlocker's mobility did not justify dispensing with a search warrant.

[4] South Dakota v. Opperman, 428 US 364 (1976).

[5] United States v. Chadwick, 433 US 1 (1977).

Note the explicit use of the phrase 'automobile exception' here, indicating that it has acquired the status of an established rule from which deviation requires justification.

In contrast, the decreased expectations of privacy associated with automobiles would license the search of a container in the boot of a car in *Ross*:[6]

> Where police officers have probable cause to search an entire vehicle, they may conduct a warrantless search of every part of the vehicle and its contents, including all containers and packages, that may conceal the object of the search.

Thus by 1985 the notion of an Automobile Exception to the Fourth Amendment had become quite well established, and the lowered expectations of privacy associated with automobiles might even be thought by some justices to justify a warrantless search without exigency, as in the *Chambers* and *Cooper* cases cited by Burger above. This had met with some resistance: for example, in Coolidge,[7] a warrantless search of an automobile had been held to be unreasonable (in this case the car had been parked in the suspect's driveway), and the majority opinion stated

> The word "automobile" is not a talisman in whose presence the Fourth Amendment fade away and disappears.

Note, however, that *Coolidge* is a 1971 case, while the the other cases are later. It does seem that by the time of the *Carney* case in 1985 it was accepted that there was indeed an automobile exception, justified by the presumed exigency of the search, given the inherent mobility of automobiles, and the reduced expectations of privacy.

The facts in *Carney* were

> A Drug Enforcement Administration (DEA) agent, who had information that respondent's mobile motor home was being used to exchange marihuana for sex, watched respondent approach a youth who accompanied respondent to the motor home, which was parked in a lot in downtown San Diego. The agent and other agents then kept the vehicle under surveillance, and stopped the youth after he left the vehicle. He told them that he had received marihuana in return for allowing respondent sexual contacts. At the agents' request, the youth returned to the motor home and knocked on the door; respondent stepped out. Without a warrant or consent, one agent then entered the motor home and observed marihuana. (*Carney*, Syllabus)

The issue here is that a mobile motor home (even a Dodge mini motor home, by no means the largest or most luxurious of this class of vehicles, as in this case) not only possesses the characteristics of a normal automobile, but also the characteristics of a home. In the words of Stevens' dissent in *Carney*:

> Although it may not be a castle, a motor home is usually the functional equivalent of a hotel room, a vacation and retirement home, or a hunting and

[6] United States v. Ross 456 US 798 (1982).

[7] Coolidge v. New Hampshire, 403 US 443 (1971).

> fishing cabin. These places may be as spartan as a humble cottage when compared to the most majestic mansion, but the highest and most legitimate expectations of privacy associated with these temporary abodes should command the respect of this Court.

The point was that Carney's vehicle was mobile and so the need to search without a warrant was *prima facie* exigent, justifying a warrantless search to facilitate enforcement of the law but the vehicle also had characteristics of a home suggesting that maybe the expectations of privacy were at least as great as in *Chadwick*, where mobility had been insufficient to justify a warrantless search, given that the expectations of privacy were greater than would normally be the case with an automobile. As Stevens expressed it:

> the citizen has a much greater expectation of privacy concerning the interior of a mobile home than of a piece of luggage such as a footlocker.

and *Chadwick* had already established that the expectations of privacy in the case of the footlocker were enough to require a warrant. Thus it seemed that the established test was not adequate to decide this case, and needed to be refined to accommodate the dual nature of the vehicle in the *Carney* case.

In oral argument this issue was addressed by inviting the counsels for the parties to propose tests for when warrantless search would be permissible and then presenting them with a series of hypothetical situations, designed to probe the suitability and efficacy of the proposed tests. As described by Rissland (1989), there are two crucial dimensions, *inherent-mobility* and *use-of-a-home*, and the hypotheticals are designed to be stronger or weaker than the actual situation of *Carney* along one of these dimensions. Thus a hypothetical in which the vehicle was in motion on the road would make it look more like an automobile, and one where it was in a trailer park and hooked up to gas and water would make it look more like a home. The purpose of these hypotheticals is to explore where the line should be drawn, so as to see on which side the actual facts fell. In Ashley (2008), the hypotheticals are located within a process model in which a test is proposed and then, using hypotheticals, attacked as too broad or to narrow. Here the weight to be given to the principle of Privacy as against the principle of Law Enforcement is explored, so as to find the correct balance between them. Sometimes the attack will be met by asserting the importance of the principle, and sometimes by modifying the test so as to incorporate some elements of the hypothetical situation.

The holding in *Carney* was that:

> When a vehicle is being used on the highways or is capable of such use and is found stationary in a place not regularly used for residential purposes, the two justifications for the vehicle exception come into play.

This is effectively a modification of the automobile exception, based on some of the hypotheticals used in Oral Argument, to require that consideration also be given to its location. As a place not regularly used for residential purposes a mobile home may be searched in a parking lot, whereas a warrant might well be required if it were found in a trailer park. Note that this test is consistent with *Coolidge*, where

the car was parked in the driveway of the suspect's home, and implicitly establishes that the driveway of a residence should be regarded as a place regularly used for residential purposes.[8]

The test is explicitly held to balance the relevant values of privacy and law enforcement. Burger's majority opinion states:

> Our application of the vehicle exception has never turned on the other uses to which a vehicle might be put. The exception has historically turned on the ready mobility of the vehicle, and on the presence of the vehicle in a setting that objectively indicates that the vehicle is being used for transportation. These two requirements for application of the exception ensure that law enforcement officials are not unnecessarily hamstrung in their efforts to detect and prosecute criminal activity, and that the legitimate privacy interests of the public are protected.

The goal of this paper is to provide a semi-formal account of the reasoning involved.

3 Formal background

In the remainder of the paper we will provide a semi-formal account of the reasoning involved in *Carney*, drawing upon existing formal AI & Law models of legal argument. Our analysis will be largely semi-formal but at various places we will indicate how it can be fully formalised in the existing models.

We assume that reasoning takes the form of applying and combining argument schemes. Argument schemes are stereotypical patterns of reasoning, consisting of a set of premises and a conclusion that is presumed to follow from them. Uses of argument schemes are evaluated in terms of a set of critical questions matching a scheme. Each unfavourable answer to a critical question indicates that there is an exception to the scheme and thus gives rise to a counterargument.

Such reasoning can be fully formalised using logics for defeasible argumentation, as used in AI & Law by e.g. Prakken and Sartor (1997), Bench-Capon and Sartor (2003), Prakken (2002), Gordon and Walton (2009). A recent abstract framework for such logics is Prakken (2010), which further develops Amgoud et al. (2006)'s attempt to integrate twenty years of work in AI on rule-based argumentation. It defines arguments as inference trees formed by applying two kinds of inference rules, strict and defeasible rules. Their informal reading is that if the premises of a strict rule are acceptable then the conclusion must be accepted no matter what, while if the premises of a defeasible rule are acceptable then the conclusion must be accepted if there is no good reason not to accept it. This naturally leads to three ways of attacking an argument: attacking a premise, attacking a conclusion and attacking an inference (respectively called undermining, rebutting and undercutting attack). By the very meaning of strict rules, an argument cannot be rebutted or

[8] The advice given at the North Carolina Justice Academy (http://www.jus.state.nc.us/NCJA/legdec94.htm) states "If the motor home is parked on the curtilage of a residence (the area immediately surrounding the home that is so intimately tied to it that it is accorded Fourth Amendment protection) it may not be searched without a warrant or consent."

undercut on an application of a strict rule. To resolve conflicts between arguments, preferences may be used, which leads to three corresponding kinds of defeat: undermining, rebutting and undercutting defeat. The framework is abstract in that it applies to any set of inference rules, as long as it is divided into strict and defeasible ones, and to any logical language with a contrary relation defined over it. Moreover, since it associates each knowledge base with a set of arguments ordered by a binary relation of defeat, the acceptability status of arguments can be defined in terms of Dung's (1995) widely studied abstract approach to argument acceptability.

Now in this paper argument schemes are assumed to be formalised as inference rules in this logical framework. On this account of reasoning with argument schemes, critical questions of a scheme give rise to undercutting counterarguments. Recall that critical questions are meant to indicate exceptions to a scheme, which means that they are not assigned to schemes formalised as strict rules, since strict rules are by definition exceptionless. Moreover, if a scheme is formalised as a defeasible inference rule, then it can be rebutted by arguments attacking its conclusion, while if a premise of a scheme is defeasibly derived by another argument, it can be attacked with an argument that rebuts that other argument. Finally, if an argument scheme uses an element from the knowledge base as a premise, its application can be undermined with an argument for a contrary of the premise (unless the premise is in the knowledge base declared to be an axiom and therefore beyond attack).

We assume that the logical language of the logic contains a connective $\rightsquigarrow$ for defeasible rules. Then the basic argument scheme that we assume is for applying defeasible rules:

Rule application scheme :

$$r : P_1, \ldots, P_n \rightsquigarrow Q$$
$$\frac{P_1, \ldots, P_n}{Q}$$

Here r is the rule's name. We assume the following critical questions of this scheme (partly inspired by Hage 1996):

CQ1: Is r valid?
CQ2: Is r applicable to the current case?

Negative answers to CQ1 and CQ2 give rise to undercutting counterarguments. Next, following Prakken (2002) and Bench-Capon and Sartor (2003), reasons for and against a conclusion are represented in separate rules and the resolution of their conflict is expressed with rule priorities:

r_1: *Pro-reasons* $\rightsquigarrow$ *Conclusion*
r_2: *Con-reasons* $\rightsquigarrow \neg$*Conclusion*
p: $\ldots \rightsquigarrow r_1 \succ r_2$

Strictly speaking, the framework of Prakken (2010) does not allow for reasoning about priorities but Modgil and Prakken (2010) extend the framework with this feature along the lines of Modgil (2009). In the present study these rule priorities

arise from value considerations (termed principles by Ashley 2008). Of each rule it is said which values it advances or demotes. Then for each rule all these values are collected and the resulting sets are compared in terms of an ordering of the values (which may itself be the outcome of a reasoning process on which values are the most important).

More specifically, if a conclusion c because of reason f is expressed with a rule

r: $f \rightsquigarrow c$

then the opinion that concluding c in case of f advances value v can be expressed as

f_1: *Advances* (r, v)

Here this is just stated as a fact but it may also be the conclusion of an argument. Similarly, where a rule demotes a value, we say

f_2: *Demotes*(r, v)

Next the information on the value(s) advanced and demoted by a rule is used to derive priorities between rules. Intuitively, the more important the set of values advanced by a rule and the less important the set of values that it demotes, the higher its priority. For possible formalisations of these ideas see Prakken (2002) and Hage (2004). Here we simply assume that this method gives rise to arguments for rule priorities.

4 A semi-formal account of some arguments in the case

We now present our semi-formal account of some arguments in the *Carney* case. We first model the legal background, after which we model the decision and some other arguments.

4.1 The legal background

Recall from our discussion of the opinions in Sect. 2 that the aim was, in Burger's words

> to ensure that law enforcement officials are not unnecessarily hamstrung in their efforts to detect and prosecute criminal activity, and that the legitimate privacy interests of the public are protected.

We interpret this as ensuring that that the circumstances have a degree of exigency such that, given the expectations of privacy appropriate to those circumstances, obtaining a warrant would impede law enforcement. In the absence of exigency, obtaining a warrant is considered to delay, but not impede, law enforcement. To be able to talk about degrees of exigency and expectation of privacy, and to be able to say that in a case there is (or is not) a degree of exigency and/or expectation of privacy that is sufficient to draw a certain conclusion, we use the following notation.

- $e(c) \leq t_e$ means that the degree of exigency in case c is less than or equal to its threshold t_e.
- $p(c) \leq t_p$ means that the degree of expectation of privacy in case c is less than or equal to its threshold t_p.

The symbol $\leq$ denotes a partial preorder on the degrees of exigency and privacy expectations. Other relational symbols are defined in terms of $\leq$ as usual. If there is no danger of confusion, the term c will be left implicit.

The Fourth Amendment requires that searches be reasonable, and leaving considerations of exigency aside, this is taken to require that a warrant be obtained, so that the probable cause for search can be shown and declared by an authorised, independent, person to justify the intrusion. In practice therefore the general rule expressing the Fourth Amendment provision can be represented as r_1. (Note that all conditions are implicitly qualified with a variable c for the case at hand.)

r_1: *Search* $\rightsquigarrow$ *Warrant required*

The vehicle exception that had become established by the time of *Carney*, which permitted a warrantless search in circumstances in which there was probable cause, sufficient exigency and sufficiently lowered expectations of privacy, can be represented as follows.

r_2: *Search* $\wedge$ *Probable Cause* $\wedge e(c) \geq t_e \wedge p(c) \leq t_p \rightsquigarrow \neg$ *Warrant required*

Taken together these two rules are intended to express that searches require a warrant unless there is a sufficiently high degree of exigency and a sufficiently reduced expectation of privacy. (Note that this rule conflict is needed to capture that the vehicle exception really is an exception to the general rule that searches require a warrant, so that the burden of proof is on the side who wants to apply it.) However, to formally capture this reading, an argument is needed for why r_2 has priority over r_1. This argument can be based on the following information (where V_p denotes the value of privacy and V_l denotes the value of law enforcement):

v_1: $\rightsquigarrow$ *Advances*(r_1, V_p)
v_2: $\rightsquigarrow$ *Advances*(r_2, V_l)
v_3: *Search* $\wedge$ *Probable Cause* $\wedge e(c) \geq t_e \wedge p(c) \leq t_p \rightsquigarrow$ *Demotes*(r_1, V_l)

Note that if r_2 had not mentioned privacy and had been simply *Search* $\wedge$ *Probable Cause* $\wedge e(c) \geq t_e \rightsquigarrow \neg$ *Warrant required*, it would still have advanced Law Enforcement, but would have also have demoted Privacy in those cases with privacy expectations above the threshold. With the additional condition, however, we can ensure that r_2 does not demote privacy.

Then we assume that from this and a method for comparing value sets, in every case where there is probable cause for a search and the conditions of r_2 are satisfied an argument can be constructed for the conclusion $r_1 \prec r_2$. Intuitively this is since r_2 advances a value without demoting the other value, while r_1 also demotes a value, in the circumstances in which the antecedent of r_2 is satisfied . Since in the absence of sufficiently exigent reasons obtaining a warrant is not considered to impede the police, r_1 does not demote law enforcement when the exigency threshold is not met.

In this case, therefore we need express no preference between the values: all we require is that neither be demoted in order to promote the other. It is a question of striking the correct balance between the values, rather than choosing between them.

Our method does not require that specific numerical values are given to the various degrees and thresholds. For example, each decision that in a certain case no warrant is needed says that in that case it holds that $e(c) \geq t_e$ and $p(c) \leq t_p$. Likewise, each decision that a warrant is needed says either that $e(c) \ngeq t_e$ or that $p(c) \nleq t_p$. This means that past decisions can be applied provided we can order $e(c)$ and $p(c)$ in the past and current cases. Of course, the correct ordering may be disputed, as in *Carney*, where Stevens' differs from the majority in the ordering of p(*Carney*) and p(*Chadwick*), as discussed below.

This representation method also respects Rissland (1989)'s analysis in terms of dimensions: each case is a point in the two-dimensional space formed by the dimensions exigency and privacy expectation. Moreover, some forms of a fortiori reasoning with dimensions are automatically captured by the method. For example, if c_1 and c_2 are cases such that $e(c_1) \geq t_e$ and $p(c_1) \leq t_p$ and we know that $e(c_1) < e(c_2)$ while $p(c_1) \not< p(c_2)$ then it follows that $e(c_2) \geq t_e$ and $p(c_2) \leq t_p$. Again no numbers are needed. As an example of this recall that Stevens' dissent in *Carney*, referring to *Chadwick*, stated

> It is perfectly obvious that the citizen has a much greater expectation of privacy concerning the interior of a mobile home than of a piece of luggage such as a footlocker.

If this is so (and in fact the majority do not accept this, positioning *Carney* relative to *Ross*), then since we know from *Chadwick* that *Footlocker* $\rightsquigarrow p(c) \nleq t_p$, it must also be the case that *Mobile Home* $\rightsquigarrow p(c) \nleq t_p$.

We feel that our approach reflects the text of Burger's decision in *Carney*, but acknowledge that there is controversy in US jurisprudence about the proper way to interpret the constitution, which is related to the issue about the proper role of the courts in relation to the legislature. Mr Justice Marshall, a dissenter in *Carney*, and a survivor from the days of Chief Justice Earl Warren, when the Court permitted itself a great deal of latitude, was of the view that it was up to the Justices to determine applicable values in the light of the current values of society. In the case of *Furman v. Georgia*[9] he noted that as society matured values change and "stare decisis must bow before changing values", and seemed quite willing for the Justices to decide what the *current* values and their relative strengths held by society are. Others, including several of the Justices appointed since Warren's retirement, would argue that that they are instead bound by the values and the ordering of values of the founders who wrote the constitution.[10] An article which addresses these issues is Lessig (1993), in which Lessig argues that judges are indeed bound by the values and value ordering of the founders, in the following way. When they propose new

[9] Furman v. Georgia, 408 US 238 (1972). In this capital punishment case Marshall actually rejected a value, retribution, that the founders had regarded as important.

[10] For example, Burger's dissent in Furman insists that retribution is a legitimate value, recognised by the founders, and able to motivate legislation.

rules—as they must for certainly circumstances that could not have been envisaged by the founders, such as the existence of automobiles, do come before the courts—the proposed rule should preserve the *balance of values* reflecting the political compromise of interests achieved by the founders. For Lessig, the issue becomes that of identifying the relevant values, the balance between them fixed by the founders, and applying this balance to the new circumstances.

We intend that our approach is neutral with respect to this controversy, at least as applied to *Carney*. We feel that it is reasonable to take the values being balanced by the founders, and both majority and dissenting opinions in *Carney*, to be Privacy and Law Enforcement. Thus we are not suggesting that the values of the current Justices differ from those of the founders. This balance is achieved by the thresholds chosen by the Justices, and the degree to which the circumstances satisfy them. It is clear (from the relative ordering of the interior of a mobile home and a footlocker stated by Stevens) that the dissent gives a higher value to $p(Carney)$ than does the majority. It might also be that the dissent sets the thresholds for privacy and exigency such that lower expectations of privacy or greater exigency is required for them to be met.[11] Lessig's argument is that they are in fact constrained in setting these thresholds to maintain the ratio set by the founders, whereas a more liberal view would be that changing society can require lower expectations of privacy for a given degree of exigency that the founders would have advocated, given the values of their time. None of this affects r_2: that simply says that the two values must be protected by their thresholds and that the circumstances must satisfy the rule. We say nothing about how the thresholds are determined, nor how $p(Carney)$ and $p(Carney)$ are determined, nor whether they are independent of one another, and it is these issues that would be affected by the controversial issues. It would, of course, be an interesting exercise to see whether the various views in the controversy could be accommodated in detail using our approach, and whether it is applicable in all cases, and in conflicting opinions on cases. For example, the use of values in *Furman* does seem to involve choice rather than balance, and different Justices take rather different stances with respect to their permitted role (Bench-Capon 2009).

4.2 The decision in *Carney*

We now apply our approach in a formalisation of *Carney*, giving the relevant quotations as footnotes. We assume the following facts:

f_1: *Search*
f_2: *Mobile home*
f_3: *Parked in parking lot*
f_4: *Licensed*
f_5: *Probable cause*

Several of these were established during the trial: a good deal of evidence was used to argue, for instance, that there was indeed *Probable cause*. Since, however, arguments justifying these facts play no role in the particular issue we are exploring,

[11] Stevens in fact argues that it would have been possible to obtain a warrant in *Carney*.

we will take the facts f_1–f_5 as accepted and to be used as premises in the arguments for whether the warrantless search was reasonable.

The majority concluded ¬ *Warrant required*. We must therefore identify a set of rules which, together with r_1 and r_2 and the preference identified from v_1–v_3 would enable this conclusion to be drawn. One such set, based on various remarks of Burger, the author of the majority opinion, might be:

r_3: *Vehicle* $\wedge$ *Readily mobile* $\rightsquigarrow e(c) \geq t_e$[12]
r_4: *Subject to pervasive regulation* $\rightsquigarrow p(c) \leq t_p$
r_5: *In use as vehicle* $\wedge$ *Licensed* $\wedge\rightsquigarrow$ *Subject to pervasive regulation*[13]
r_6: *Vehicle* $\wedge$ *Setting objectively indicates use for transportation* $\rightsquigarrow$ *In use as vehicle*[14]

We also need some commonsense rules to enable the inference to be drawn. These are intended to be obvious and uncontroversial.

r_7: *Parked in parking lot* $\rightsquigarrow$ *Setting objectively indicates use for transportation*
r_8: *Mobile home* $\rightsquigarrow$ *Self propelled* $\wedge$ *Wheels*
r_9: *In use as vehicle* $\rightsquigarrow$ *Readily mobile*
r_{10}: *Self propelled* $\wedge$ *Wheels* $\rightsquigarrow$ *Vehicle*

These rules can be used to derive the desired conclusion from r_2 as shown in Fig. 1. Of course, the opposite conclusion can be drawn on the basis of r_1 but, as discussed above we assume that r_2 is preferred to r_1 from a consideration of the values promoted and demoted by the rules in the case situation. Such an account, however, takes no cognisance of the fact that we are dealing with a mobile home, which can be used as a home as well as a vehicle and thus potentially is afforded the protection due to a home. We might construct a counterargument using the following rules.

r_{11}: *Mobile home* $\wedge$ *Stationary* $\rightsquigarrow$ *In use as home*
r_{12}: *Parked in parking lot* $\rightsquigarrow$ *Stationary*
r_{13}: *In use as home* $\rightsquigarrow p(c) \not\leq t_p$

These rules would give Stevens' dissent, which is based on the idea that Carney's expectations of privacy could not be considered sufficiently lowered to permit a warrantless search (see Fig. 2). These rules could be used to block r_2, since, if we prefer r_{13} to r_4, they defeat the premise that the privacy threshold is respected, leaving us to conclude that a warrant was indeed required for the search using r_1.

[12] The capacity to be "quickly moved" was clearly the basis of the holding in *Carroll*, and our cases have consistently recognized ready mobility as one of the principal bases of the automobile exception.

[13] There is a reduced expectation of privacy stemming from its use as a licensed motor vehicle subject to a range of police regulations inapplicable to a fixed dwelling. This is intended to represent Burger's argument in *South Dakota v. Opperman*, quoted above.

[14] This is intended to represent Burger's finding in *Carney* that the vehicle was so situated that an objective observer would conclude that it was being used not as a residence, but as a vehicle. This is the test that was introduced in this case to identify situations where a mobile home could be searched without a warrant.

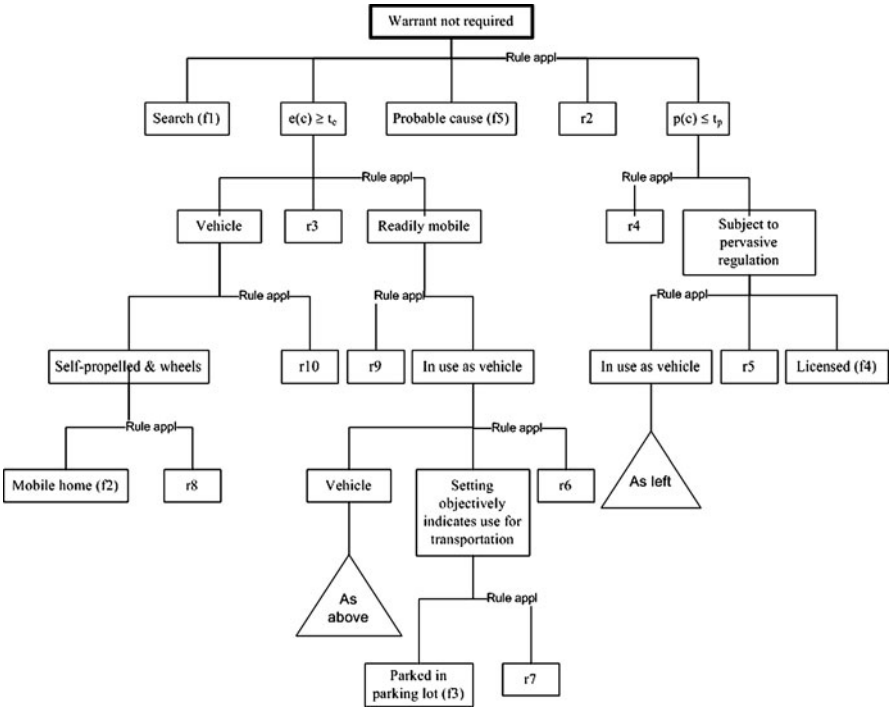

Fig. 1 The majority opinion

It is not, however, necessary to prefer r_{13} to r_4, and it would be possible to reinstate the threshold premise by expressing a preference for r_4 over r_{13}. This the majority might be prepared to do, but their comment

> Our application of the vehicle exception has never turned on the other uses to which a vehicle might be put. The exception has historically turned on the ready mobility of the vehicle, and on the presence of the vehicle in a setting that objectively indicates that the vehicle is being used for transportation. These two requirements for application of the exception ensure that law enforcement officials are not unnecessarily hamstrung in their efforts to detect and prosecute criminal activity, and that the legitimate privacy interests of the public are protected.

suggests that they would not wish to be seen as stating such a preference, but rather as giving due weight to the privacy interests, and so they would not wish to deny the applicability of r_{13}. Rather they would wish to reject r_{11}, preferring instead

r_{14}: *In use as Vehicle* $\rightsquigarrow \neg$ *In use as Home*

using r_{14} means that r_{13} is no longer applicable and so there is no need to commit to the relative priority of r_4 and r_{13} (see the rebuttal on the right in Fig. 2). This fits well with a footnote to the opinion which says

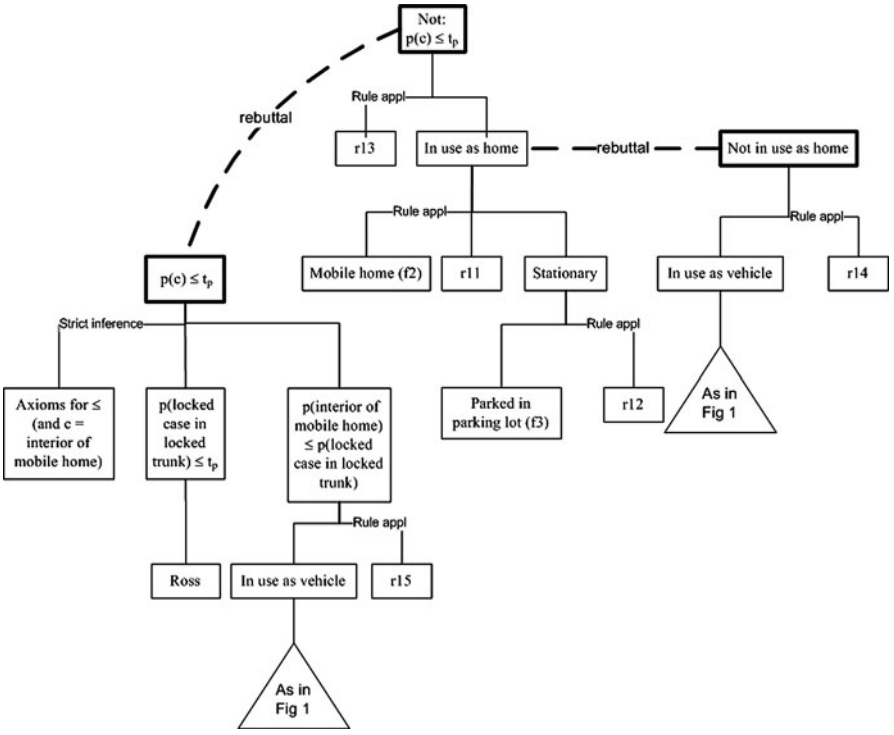

Fig. 2 Stevens' dissent and its refutations

> We need not pass on the application of the vehicle exception to a motor home that is situated in a way or place that objectively indicates that it is being used as a residence.

and then offers a list of factors which might be considered relevant to such a question.

In fact, there is a representation issue here, namely, how does stating rule r_{14} reject rule r_{11}? One way to deal with this issue is to say that strictly speaking the majority which proposes r_{14} is argumentatively incomplete, since they simply adopt the rule and do not explain why they reject the conflicting rule r_{11} proposed by the dissent. All that can be known for sure is that by adopting the rule r_{14}, the majority have implicitly rejected the validity of rule r_{11}. In the present logical model this can be formalised as a trivial argument consisting of just the statement $\neg Valid(r_{11})$, which gives a negative answer to CQ1 of the Rule application scheme. Ideally, further grounds should be given for this negative answer but such grounds have not been explicitly stated by the majority.

We might finally suggest an answer to the dissent's contention mentioned at the end of Sect. 4.1 that the privacy expectations of a mobile home were greater than a piece of luggage. The majority cite a number of cases where, like *Ross*, warrantless search of car trucks, and sealed containers in car trunks were allowed. Since a

separately lockable area of a vehicle should arouse greater expectations of privacy than to interior of a mobile home, which is a single space, it seems reasonable that

r_{15}: *In Use as Vehicle* $\rightsquigarrow p$(*locked case in locked trunk*) $\geq p$(*interior of mobile home*)

Since cases such as *Ross* had established that the locked case in the locked truck was below the privacy threshold, if one accepts r_{15} one has to conclude that the interior of the mobile home is also below the threshold (see the rebuttal on the left in Fig. 2). Rule r_{15} can be seen as and exception to r_{13} for the case that the object in use as a home is also in use as a vehicle. One way to express this exception is with the following rule:

r_{15a}: *In Use as Vehicle* $\rightsquigarrow \neg$ *Applicable*(r_{13})

Note that r_{15} denies Stevens' claim that *It is perfectly obvious that the citizen has a much greater expectation of privacy concerning the interior of a mobile home than of a piece of luggage such as a footlocker*, at least while the mobile home is in use as a vehicle.

These rules enable us to produce the reconstruction of the argument underlying the majority opinion given in Fig. 1, and Stevens' dissent as shown in Fig. 2. We can also, as shown in Fig. 2, supply some rebuttals of Stevens' arguments.

4.3 Tests and hypotheticals in the oral argument

So far we have been able to (semi-)formally reconstruct the majority and dissenting opinions in *Carney* with a variety of tools from AI & law research on formalising legal argument. We now turn to a reconstruction of some hypotheticals from the oral argument. It will turn out that an additional tool is needed, namely, the inclusion of metalevel reasoning in argument schemes.

The majority opinion in *Carney* does not contain hypotheticals but they are extensively used in the oral arguments, and several of the conclusions in the opinion can be seen as based on these exchanges. An example discussed by Ashley (2008) (his Fig. 2)[15] starts with a proposed test

> If search is of a self-propelling vehicle with wheels then no warrant required.

which is attacked with a hypothetical

> What if the vehicle is self-propelled but has been in one of these mobile home parks for three months and it's hooked up to water and electricity but still has its wheels on?

Such hypotheticals cannot be modelled as above, since the various hypothesised conditions are not true in the current case, and may be incompatible with the actual facts (a vehicle cannot be in a trailer park and a parking lot at the same time). This raises the long standing problems associated with the treatment of counterfactual

[15] The examples in Ashley (2008) paraphrase the actual exchange. An extract from the transcript can be found in Rissland (1989).

conditionals (Lewis 1973): the difficulty is that we need the hypothetical situation to be as close as possible to the actual situation, whilst being consistent. The hypotheticals do not simply add extra facts, but require some of the actual facts to be modified, and there are often problems in determining which facts should be modified. So we cannot model this test plus attack as follows:

Proponent:

Vehicle $\wedge$ *Self-propelled* $\wedge$ *Wheels* $\rightsquigarrow$ *No warrant needed*
Vehicle $\wedge$ *Self-propelled* $\wedge$ *Wheels*
Therefore, *No warrant needed*

Opponent:

Vehicle $\wedge$ *Self-propelled* $\wedge$ *Wheels* $\wedge$ *In trailer park* $\ldots \wedge$ *Hooked up to water* $\ldots \rightsquigarrow$ *Warrant needed*
Vehicle $\wedge$ *Self-propelled* $\wedge$ *Wheels* $\wedge$ *In trailer park* $\ldots \wedge$ *Hooked up to water* ...
Therefore, *Warrant needed*.

The problem with this modelling is that the conditions *In trailer park* … and *Hooked up to water* … are not compatible with the facts of the *Carney* case. So a way is needed to let possible exceptions defeat a test even when they are in conflict with the facts of the current case. Mackie argued that counterfactuals should be seen as elliptical arguments (Mackie 1973). One way to model such arguments in the present setting is to regard them as metalevel arguments that refer to what follows from certain rules and facts (cf. Routen and Bench-Capon 1991). For tests that only propose sufficient conditions this is captured by the following argument scheme.

Rule validity scheme :

$$\frac{\{T\} \cup \textit{Relevant knowledge} \mid\sim \textit{Legal conclusion}}{r : T \rightsquigarrow \textit{Legal conclusion} \text{ is valid.}}$$

Here $\mid\sim$ is a consequence notion for some argumentation logic in which the use of the argument schemes proposed in this paper is fully formalised, i.e., a suitable instantiation of the framework of Prakken (2010). To derive the rule itself from the conclusion that it is valid, we assume an argument scheme inspired by recent work of Sartor (2009) and Bex (2009) and that is also used in Prakken (2011):

Rule derivation scheme

$$\frac{r : \varphi \rightsquigarrow \psi \text{ is valid}}{r : \varphi \rightsquigarrow \psi}$$

This argument scheme is meant to be a strict inference rule, therefore it has no critical questions.

We suggest the following critical questions are applicable to the rule validity scheme:

CQ1: Is there a set of conditions C and a set of additional relevant knowledge R such that $\{T\} \cup C \cup$ *Relevant knowledge* $\cup R \not\mid\sim$ *Legal conclusion*?
CQ2: Are the test's conditions T easily observable?

A positive answer to CQ1 and a negative answer to CQ2 give rise to undercutters of arguments using the Rule validity scheme. The first critical question in fact comprises a range of ways of criticising the application of the scheme, since both C and R may contain any piece of actual or hypothesised information that invalidates the object-level inference of *Legal conclusion*. For instance, it could be used to question whether the thresholds were correctly set, whether the degree of exigency exceeds the threshold, whether the rules advance or demote the values, or whether the rules in the relevant knowledge were applicable to the case in hand or valid.

It should be noted that full formalisation of the use of metalevel reasoning in argument schemes is by no means trivial, witness the extensive body of research in the past on metalogic; see e.g. Kowalski and Kim (1991) and for legal applications see Routen and Bench-Capon (1991) and Hamfelt (1995). In the present paper it is not our aim to provide such a full formalisation. Rather, our aim is to show that hypothetical legal case-based reasoning makes use of metalevel reasoning and to give an initial semi-formal account of how such reasoning may be incorporated in logical AI & law models of legal argument. A full formalisation and investigation of its properties must be left for future research.

We next apply the rule validity scheme to the hypothetical of Ashley (2008)'s Fig. 2. From hereon we assume unless stated otherwise that *Relevant knowledge* contains at least the above r_1, r_2, r_7–r_{10}, r_{12} and v_1–v_3. We also assume that in all tests *Search* and *Probable cause* are not challenged and so can be implicitly assumed. Then in the hypothetical of Ashley (2008)'s Fig. 2 the proposed test is:

$$\textit{Wheels} \wedge \textit{Self-propelled} \rightsquigarrow \neg\ \textit{Warrant required}$$

With r_{10} the conditions of this test imply *Vehicle*. Now to derive $e(c) \geq t_e$ this test arguably puts in *Relevant knowledge* a version r'_3 of r_3 without the condition *Readily mobile* and a 'faulty' version r'_2 of r_2 without the condition $p(c) \leq t_p$:

$$[r'_2\text{:}]\ \textit{Search} \wedge \textit{Probable cause} \wedge e(c) \geq t_e \rightsquigarrow \neg\ \textit{Warrant required}$$
$$[r'_3\text{:}]\ \textit{Vehicle} \rightsquigarrow e(c) \geq t_e$$

Then we have that $\neg$ *Warrant required* is implied, since an argument can be constructed as in Fig. 3, which has no counterarguments (in this figure R stands for 'Relevant knowledge').

The attack as being too broad in case of *In trailer park …* and *Hooked up to water …* then applies CQ1 by adding these conditions and *Mobile home* to C, adding the correct version of r_2 to R and also adding $\neg Valid(r'_2)$ to R (recall the first critical question to the rule application argument scheme). Furthermore, it adds to R the rules r_{13} and:

$$r_{16}\text{: } \textit{Mobile Home} \wedge \textit{In trailer park} \ldots \wedge \textit{Hooked up to water} \ldots \rightsquigarrow \textit{In use as home}$$

Then $\neg$ *Warrant required* does not follow any more since now r_2 is needed again to build an argument for this conclusion (cf. Fig. 1) and its condition $p(c) \leq t_p$ is not satisfied. In fact, there now is an unattacked argument for the negation of this condition, namely, the argument in Fig. 4. What is happening here is that the proposed test is effectively modifying r_3 by removing the condition that it should be

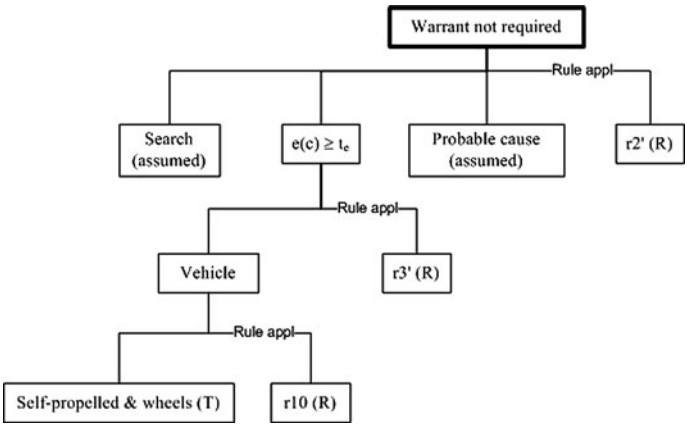

Fig. 3 A hypothetical meta-argument proposing a test

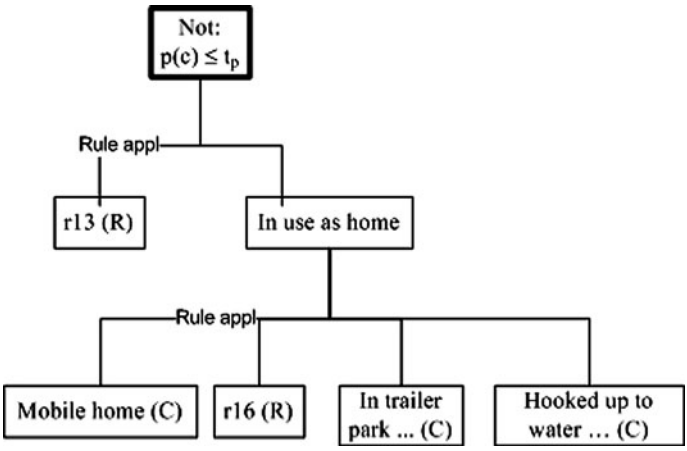

Fig. 4 Attacking the test as too broad

readily mobile. The hypothetical is intended to show that this modification is not acceptable, since it would then cover cases where the vehicle should be afforded the privacy appropriate to a home. In the extract given in Rissland (1989) counsel responds by restoring the mobility criterion, effectively proposing r_3 as his test. The Justices, however, pose further hypotheticals indicating the view that a mobile home, in a trailer park and lived in as a residence for several months would have privacy expectations above the threshold. It was the considerations raised by this sort of exchange that meant that the majority opinion did not rely on r_3 as the test, but added r_6, referring to the location of the vehicle which had not been explicitly stated in this form in earlier cases. Thus we can see r_6, the main innovation of *Carney*, as coming from the hypothetical reasoning.

A continuation of this exchange is quoted in Rissland (1989). The justice asks

J-2b: And you would apply it, even if it had been parked there three months or so, because your officer would not really know how long it had been parked?
A: That is correct.

This relates to CQ2. The Attorney is arguing against a test proposed by the justice involving a condition relating to how long the vehicle had been parked on the grounds that this could not be part of an effective test, since it was not readily observable.

The third hypo in Ashley (2008)[16] is similar to the first but is directed at a test proposed by the defence that if something has the attributes of a home it should be treated like a home. Justice Marshall proposes that something which was indisputably a vehicle, such as a limo or a van, might have attributes of a home, such as curtains and a bed. This is in part using CQ2 to cast doubt on the ability of attributes of a home to provide an effective and objective test, but also to suggest that the test is too broad, in that having attributes of a home might not be sufficient. When counsel hesitates to concede, it is further suggested that the van be travelling on a public road at 55 mph. Now counsel concedes that it should be treated as in use as a vehicle, effectively assenting to r_{14}. But counsel does not concede r_6. Instead he suggests that a vehicle should be treated as in use as a vehicle only if it is *imminently mobile*, explained as the key being in the ignition (Rissland 1989). Thus the test to be added would not be r_6, but something like r_{6a}.

r_{6a}: *Vehicle* $\wedge$ *Imminently Mobile* $\rightsquigarrow$ *In use as vehicle*

transferring attention from the location of the vehicle to its readiness to move. Moreover he would contend that the vehicle in *Carney* was not imminently mobile, since there were curtains drawn over the windscreen. Note that the test for use as a vehicle in r_{6a} covers the hypothetical but not the facts of *Carney*. Ultimately, however, the test proposed in r_{6a} for use as a vehicle was rejected by the Court in favour of r_6.

The following scheme is for tests that also propose necessary conditions.

$$\frac{\{\neg T\} \cup \textit{Relevant knowledge} \mid\sim \neg \textit{Legal conclusion}}{r : \neg T \rightsquigarrow \neg \textit{Legal conclusion} \text{ is valid}}$$

As critical questions it has CQ1 and CQ2 of the previous scheme plus:

CQ3: Is there a set of conditions C and a set of additional relevant knowledge R such that $\{\neg T\} \cup C \cup \textit{Relevant knowledge} \cup R \mid\sim \textit{Legal conclusion}$?

This scheme and question allow us to give a precise interpretation of Ashley (2008)'s attacks on a test as too narrow. Such attacks interpret a test as giving both necessary and sufficient conditions for a legal conclusion. According to CQ3 an attack as being too narrow then amounts to saying that there are cases where the

[16] Also a paraphrase of the extract quoted in Rissland (1989).

necessary conditions are not fulfilled but the legal conclusion should still be drawn. As an example we use an exchange from Rissland (1989).[17]

J-4: What would you do with a houseboat?
A: A houseboat? I think that would be covered, and I think that the-
J: It has wheels?
A: No, it is a vessel, and covered by the same rule....

This hypothetical could be directed against the proposed test of wheels and self propelled that was explored above. This time, however, the suggestion is that the test is too narrow, since if a motor home can be searched without a warrant, a houseboat should receive the same treatment, although it does not fall within the test since it has no wheels. The counsel's reply suggests that his test was meant to cover houseboats as well. Actually this suggests that wheels and self propelled was not what he meant at all, but rather something more like 'vehicle or vessel' was intended and he had focussed on the 'vehicle' disjunct when proposing his test, using the definition of 'vehicle' given by r_{10}. By admitting vessels to be also covered he is modifying r_6 to r_{6b}:

r_{6b}: (*Vehicle* or *Vessel*) $\wedge$ *Setting objectively indicates use for transportation* $\rightsquigarrow$ *In use as vehicle*

with some suitable definition of vessel assumed among the common sense rules.

We can thus see how the hypotheticals quoted in Ashley (2008) and Rissland (1989) can be seen in terms of the three critical questions to our argumentation schemes for hypotheticals.

5 Conclusion

We have illustrated in a case study how formal AI & law models of legal argument can be used to model and clarify hypothetical and value-based case-based reasoning. In particular, we have illustrated how formal tools can be used to model and evaluate tests proposed by counsel in Oral Argument, providing an interpretation of three ways to attack these proposals using hypotheticals, and clarifying the role of values and principles. We have also shown how one aspect of dimension-based reasoning, namely, a fortiori arguments, can be modelled. On the other hand, what we have not modelled is references to precedents and heuristics for modifying tests or for generating hypotheticals, which we leave for future work.

Our approach also relates to some aspects of Loui and Norman (1995), who presented several types of rationales of precedents. The schemes presented in Sect. 3 are similar to their idea of a *compression* rationale, which summarises a line of reasoning in a single rule. Essentially, a precedent's decision d in case of facts

[17] We use this example rather than the example given in Ashley (2008), since that example greatly condenses the actual exchange. The justice hypothesises that a tent is pitched next to the van. It is not clear to us whether the justice thinks the tent should be subject to search, which would be a case of the test being too narrow, or that it should not, despite the fact that it can be readily moved, and that insufficient weight is given to privacy considerations in the proposed test.

f (expressed as a rule $f \rightsquigarrow d$), may have resulted from reasoning with a chain of rules $f \rightsquigarrow \cdots \rightsquigarrow g \cdots \rightsquigarrow d$. If one side presents an argument with premise $f \rightsquigarrow d$ and the other side has an argument against g, then it can decompress the rule into the line of reasoning and attack the thus modified argument with its argument against g. In our terms this argument move says "your rule was derived with the Rule validity scheme and I have a counterargument based on CQ1".

Moreover, since the metalevel premises of our schemes in Sect. 3 refer to a defeasible consequence notion $|\sim$, which may involve the resolution of conflicts between arguments, our schemes are also similar to Loui and Norman (1995)'s disputation rationales, which summarise the resolution of a conflict between arguments in a single rule (in fact, compression rationales are a special case of disputation rationales). In Loui and Norman (1995), a precedent rationale used by one side may in such cases by the other side be unpacked into the set of arguments plus defeat relations that gave rise to the rule, and be attacked by arguing that in the current case there are additional arguments that change the outcome or that in the current case some arguments that applied in the precedent do not apply, which changes the outcome. Again translated to our framework such attacks say "Your rule was derived with the Rule validity scheme and I have a counterargument based on CQ1".

We have not, however, modelled some other rationales discussed by Loui and Norman (1995), such as their their *fit* rationale, which relates to how well a case decision fits with a body of precedents.

Finally, in our analysis of hypothetical arguments we included forms of metalevel reasoning in several argument schemes, by referring in their premises to the consequence notion of the logic in which we formalise their use. As remarked above, a full formalisation of this idea is by no means trivial, which therefore is an important issue for future research.

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