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Values and Factor Ascription Arguments

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Abstract. Argumentation is often an attempt to resolve disagreement, but it is not always possible to reach a resolution. This is illustrated in law where multi-judge trials often end with a split decision. Not only do the judges disagree as to outcome (*dissenting* opinions), but also as to the reasons for a given outcome (*concurring* opinions). These disagreements can be explained in terms of different values held by the judges concerned. But while the role of values in determining which arguments are *accepted* has been widely explored, values can also determine which arguments can be *constructed*. The paper provides an analysis of this phenomenon.

Keywords. Disagreement, Reasoning with Cases, Factor Ascription, Values

1. Introduction

Modelling legal argument about cases has long been a central topic of Artificial Intelligence and Law [13]. In the dominant approach, cases are described as sets of *factors*, which are stereotypical fact patterns that provide a reason to decide for one of the disputants. A case comprises a set of pro-plaintiff factors and a set of pro-defendant factors; the decision depends on which set of factors is preferred. This approach originated with the dimensions of HYPO [18] and the factor-based approach in CATO [1]. For an overview of the development, see [5].

A key feature of legal case reasoning is that judges can disagree as to the outcome. According to the Supreme Court Database, between 2000 and 2018 a unanimous decision was recorded in only 36% percent of all decisions. 5-to-4 decisions, by comparison, occurred in 19% of cases[2], where there are majority and dissenting opinions. We also find *concurring* opinions, where judges agree on the outcome but with different reasons.

Concurring opinions are particularly interesting in relation to argumentation. They represent disagreement amongst agents about the reason for a conclusion, yet they maintain agreement about the conclusion. Moreover, the concurring opinion need not attack the argument in the majority opinion: if the concurring judge has the broader interpretation it can be read as *inclusive or* rather than *exclusive or*. Concurring opinions can be reused in case-based reasoning in some subsequent case.

Interestingly, Perelman in [15] provided a typology of disagreements, which includes such alternative opinions:

[1] Corresponding Authors: Tomasz Zurek, Adam Wyner, Trevor Bench-Capon. This paper was substantively written just prior to Trevor Bench-Capon's untimely death on 20 May 2024. We dedicate the paper to him.
[2] Washington Post 28th June 2018.

> "If men (*sic*) oppose each other concerning a decision to be taken, it is not because they commit some error of logic or calculation. They discuss apropos the applicable rule, the ends to be considered, the meaning to be given to values, the interpretation and characterisation of facts."

In AI and Law since [9], these differences have been explained in terms of the different purposes ("ends") or values promoted or demoted by accepting the reasons represented by the factors [7]. This addresses some of Perelman's reasons for disagreement. In this paper, we address other reasons for disagreement, namely, "the characterisation of facts".

In [16], precedent cases are described as sets of factors using rules and priorities between them. Based on this, a logic of precedential constraint was presented in [11], which proposed the *reason* model: the reason for the winning side can be a *subset* of the factors available to that side. Different subsets can motivate concurring opinions. While this work establishes an approach to reasoning from factors to outcome, the arguments reason from *Factors* to *Outcome* in a single step, which is a simplification. Yet, [16] claimed that such arguments are incapable of capturing all the nuances of legal reasoning and should be seen as "limiting cases of a richer framework." In particular, many cases whether a particular factor is present in a case rather than a preference between factors.

In *Escola v. Coca-Cola Bottling Co. (1944)*, which is our main example, the key factor was whether the manufacturer should take responsibility for a defective product. While the majority relied on imputed negligence to establish the manufacturer's responsibility, a concurring opinion argued for strict liability.

The case suggests that judges can characterise cases differently despite having the same facts, factors, legal rules, and training in legal reasoning. This is striking given the presumption that "justice is blind" to outside influences and personal preferences. Yet, this is not the case, as argued theoretically since [9] and textually in [10]. In particular, the main line of development and key contribution of the paper is that judges attribute factors and so decide cases relative to their *values*, which explains how agents (judges) select factors in the construction of their arguments.

Recently there has been more focus on factor ascription [14], and this step has been provided with argumentation schemes [8]. Adding factor ascription suggests a two step argument from *Facts* to *Factors* and from *Factors* to *Outcomes*. As the example shows, values may be relevant at both stages. Although the second step has been widely discussed in the literature, the first still requires further development.

In this paper we will discuss how values affect factor ascription and so may lead to different opinions amongst judges. This supplements single step approaches [4] and develops from [20], wherein agents use their values to select what appears in their arguments. More generally, the analysis highlights the role of values in *forming* instantiated arguments, which is complementary to *evaluating* them as in VAFs [3].

The structure of the paper is as follows. In Section 2 we describe the different opinions in our example case and model the competing arguments in terms of factors and values. Section 3 gives a machinery for ascribing factors, taking into account the different weights different judges place on different values. Section 4 applies this to the *Escola* case, and several hypothetical variants. Section 5 offers a discussion and pointers to future work while Section 6 makes some concluding remarks.

Table 1. Dimension for Factor *Responsibility*

	Public Good	Fairness	Enterprise
Sabotage by Outsider	8	-7	-10
Sabotage by Employee	6	-5	-9
Not Negligent	4	-3	-8
Imputed Negligence	2	-1	-6
Proven Negligence	1	2	-4
Inadequate Safety Procedures	1	4	-2
Deliberate Act	1	6	-1

2. Escola v Coca Cola Bottling Co.

In *Escola v. Coca-Cola Bottling Co.(1944)*, majority and concurring opinions are given. The justices make different choices about their applicability of facts and rules.

2.1. The decisions

In *Escola*, the plaintiff was injured when a Coca Cola bottle she was holding exploded, inflicting a deep cut on her hand. The majority opinion was delivered by Gibson, who relied on the doctrine of *Res ipsa loquitur*, which imputes negligence to the manufacturer if no else can be shown responsible. He stated that this doctrine only applies if plaintiff can prove that the defect did not occur after it left the defendant's possession.

In a concurring judgement, Traynor argued that the manufacturer has an absolute liability, so that negligence need not be imputed. He justified this for public policy which:

> demands that responsibility be fixed wherever it will most effectively reduce the hazards to life and health inherent in defective products that reach the market.

Thus Traynor argues that it is for the Public Good that manufacturers should compensate whether negligent or not, since they can be more prepared to stand the loss.

2.2. Representation

From these decisions we identify two factors with dimensions: *Responsibility*, applying if the manufacturer is held liable for the defect and is pro-plaintiff; and *Damage*, applying if the damage occurred after it left he control of the manufacturer and is pro-defendant. We see three values as being concerned: *Public Good*, *Fairness* and *Enterprise*.

Responsibility has a dimension of the degree of relation of the manufacturer to the defect. In the extreme pro-defendant case, the defect is caused by external sabotage, and in the extreme pro-plaintiff case the manufacturer is aware of the defect. *Fairness* is demoted unless the manufacturer can be shown responsible for the damage since otherwise there will be cases where the manufacturer will be liable although blameless. Fairness is promoted if the blameworthy are held liable. *Public good* is promoted if the manufacturer is held liable, since the manufacturer is best placed to meet the costs. *Enterprise*, arguably, is promoted by deregulation, and so holding manufacturers liable demotes this value. The degrees of promotion and demotion increase towards the extremes of the dimension. *Responsibility* and its degrees of promotion and demotion are shown in Table 1.

Table 2. Dimension for Factor *Damage*

	Public Good	Fairness	Enterprise
At Manufacturer	-8	-10	6
In Transit	-3	4	4
After Delivery	-4	9	2

Table 3. Value Weights for the Judges

	Public Good	Fairness	Enterprise
Gibson	3	5	0
Traynor	8	4	0
Ishmael	6	7	0
Freemarket	2	6	6
Smallstate	0	2	8

The *Damage* factor runs from the extreme pro-plaintiff point where the manufacturer had control to the extreme pro-defendant point where it was incurred after delivery. *Public Good* is demoted if the manufacturer avoids liability. *Fairness* is demoted if the damage occurred during manufacture, but promoted if it occurred after it left the manufacturer's control. *Enterprise* is promoted by ascribing this factor. The dimension and weights for the various dimension points are shown in Table 2.

Finally we represent value preferences of the judges as weights. As well as the two *Escola* judges, Gibson and Traynor, we include some extra, fictional, judges to use in some hypothetical variants. Since we know that Gibson and Traynor both ascribe *Responsibility* at *ImputedNegligence*, we know that both recognise *Public Good* and *Fairness* as values. But since Traynor wants strict liability, he favours *Public Good* to a significantly greater degree. We introduce a third judge, Ishmael, with a position between Gibson and Traynor. Two other judges recognise *Enterprise* as a value, with Smallstate more extreme than Freemarket. The weights for the Judges are shown in Table 3.

What is important is the relative weights of the values for a particular agent. Thus, for example, Traynor prefers *Public Good* to *Fairness* with a ratio of 2 to 1. Ishmael prefers *Fairness* to *Public Good*, but the preference is much less marked, a ratio of 1.16 to 1. Gibson has a stronger preference for *Fairness*, 1.73 to 1.

3. Ascribing Factors

This section describes how we use the agent weights and the weights for dimension points to determine which agents will ascribe a factor to the case.

In the introduction, we pointed out that the argument creation comprises two steps: (1) from Facts to Factors, and (2) from Factors to Outcome. Although the second step has been widely discussed in the literature, the first still requires further development. The main question is: *how do agents select factors in the construction of their arguments*?

The process of factor ascription can be divided into two phases:

1. From facts to points on dimensions.
2. From points on a dimension to factors.

Re 1. This stage maps a certain set of facts to certain points on various dimensions. In order to represent such a mechanism we need a definition of dimension:

Definition 1 *Let dimension* $D = \{p_x, p_y, ..., p_n\}$ *be a set of totally ordered elements called points on dimension, such that* p_x *is extremely pro defendant,* p_n *extremely pro plaintiff. Let* $\mathscr{D}$ *be a set of all dimensions of a particular case. We also assume that* $D_x \cap D_y = \emptyset$ *for any* $D_x, D_y \in \mathscr{D}$.

Definition 2 *Let* $Facts = \{f_1, f_2, ...\}$ *be a set of all possible facts relevant to a case.*

Facts allow us to represent a *Case Fact Description*:

Definition 3 *Let* $C = \{f_x, f_y, ...\}$ *be a Case Fact Description, a set of facts which represent a particular case. That is,* $C \subseteq Facts$

Note that facts are distinct from factors. "The manufacturer did not check the product" is a fact leading to the dimension point "the manufacturer was negligent" on the basis of which we may wish to ascribe the factor "the manufacturer was responsible for the defect". It is the factor that is the reason to decide for the plaintiff. We can then introduce the mechanism mapping from facts to particular point on dimension:

Definition 4 *Let* Δ *be a set of functions* δ_D*, where every function* $\delta_D : 2^C \rightarrow D$ *is a function mapping from a case to a particular point on dimension D. There is only one function* δ_D *for every dimension in* $\mathscr{D}$.

We do not specify any particular shape of function δ, which can be argumentation schemes, (defeasible) rules, or some classification mechanisms, including machine learning-based. One of the approaches to represent δ function is HYPO [2].

Re 2. Given assigned points on dimensions for a case, we can introduce the mechanism of factor ascription. In order to model factor ascription we define a relation between a particular dimension and factor. If a given point on a dimension will be acceptable to the judge with respect to his/her values, he can ascribe a factor related to this dimension.

Definition 5 *Let* $\mathscr{F} = \{F_1, F_2, ...F_m\}$ *be a set of factors. We assume a bijective function* $\rho : D \rightarrow F$ *which maps factors to dimensions. In other words, every factor is assigned to one dimension and every dimension has exactly one factor. We denote it by unified subscripts. If* D_x *then its factor is* F_x.

Note that there is only one factor for a dimension, and it favours a particular party. Therefore, a factor does not represent a point on dimension, but a particular dimension relates to particular factor. In our example, *Responsibility* favours the plaintiff and *Damage* favours the defendant. So either the factor is ascribed or withheld. If it is ascribed, it favours the same particular party.

The *key point* is that the judge ascribes factors on the basis of values. Many authors (e.g. [15] and, in AI and Law, [4]) point out that the root of disagreement between people is not only in the lack of knowledge or reasoning errors, but in the differences in preferences between values.

In order to represent the relations between values and factors, we introduce the concept of value (discussed previously in, e.g., [3, 21, 19], we so not attempt a detailed def-

inition). With $V = \{v_1, v_2, ...\}$ we denote a set of values, and with $A = \{a_1, a_2, ...\}$ we represent set of all judges. These two concepts allow us to define an agent's value profile:

Definition 6 *Let $VW : A \times V \rightarrow [0...10]$ be a function assigning the weight given to a value v by an agent a, represented by an integer between 0 and 10.*

The value profile of a judge represents his/her personal attitude towards various values, which values he respects more, less, or not at all (i.e., 0).

Now we introduce how particular points on dimensions relate to values.

Definition 7 *Let $WDP : D \times V \rightarrow [-10...10]$ be a function assigning for a particular value and point on dimension a weight expressed by a number from range [-10;10].*

In order to ascribe factors to a case it is necessary to introduce a function which adds a particular factor to a case description. Note that since agents differ in terms of their values and factors are ascribed on the basis of values, then case descriptions should be individualised. We clearly distinguish the representation of cases as fact-based (Case Fact Description) and a factor-based (Case Factor Description). Case Fact Descriptions are common to all agents, whereas each agent has their own Case Factor Description.

Definition 8 *Let $CD_a \subseteq \mathscr{F}$ be a Case Factor Description, a set of factors ascribed by an agent a to a given case.*

We can now formally model how factors are ascribed to a case. The basic and clearest situation is when a given point on a dimension is positively evaluated in the light of all meaningful values. By meaningful values for a given agent, we mean all the values for which this agent assign weight higher than zero ($VW(a,v) > 0$).

Definition 9 *Suppose an agent $a \in A$. If by V_a we denote set of all values for which $VW(a,v) > 0$ (they are meaningful for agent a), then particular factor Fx represented by a Dimension Point p_y on Dimension D_x will be added to agent a's Case Factor Description when this Dimension Point will be positive for all meaningful values:*
$CD_a = \{F_x \mid p_y \in D_x \wedge \rho(D_x) = F_x \wedge \forall_{v \in V_a}(WDP(p_y, v) > 0)\}$

Note that if factor F_x, for all agents and values, has all its $WDP(p_x, v)$ positive, then this factor is ascribed by all agents. We can say that this is an uncontroversial factor.

Sometimes, however, a point on dimension which relates to a given factor is much more problematic: it promotes some values, but also demotes some others. In such a case an agent will have to *balance values*, to recognize whether, given the importance of values, positive values outweigh negative ones. Yet, different agents have different attitudes towards values (which is expressed by agent's Value Profile), which also influence the balancing mechanism. In order to represent this mechanism some additional concepts should be introduced: Let $WDP^+_{p_y}$ be a set of positive values assigned to a particular dimension point p_x ($WDP^+_{p_y} = \{v \mid WDP(p_y, v) \geq 0\}$), $WDP^-_{p_y}$ be a set of negative values assigned to a particular dimension point ($WDP^-_{p_y} = \{v \mid WDP(p_y, v) < 0\}$). The factor ascription mechanism can be formalised as:

Definition 10 *Suppose an agent $a \in A$:*
$CD_a = \{F_x \mid p_y \in D_x \wedge \rho(D_x) = F_x \wedge$
$(\Sigma_v^{WDP^+_{p_y}}(WDP(p_y, v) * VW(a,v)) \geq (|\Sigma_v^{WDP^-_{p_y}}(WDP(p_y, v) * VW(a,v))|))\}$

The key assumption of the above definition is that multiplying the Weight Dimension Point for a value by the weight assigned to that value by a given agent, relates the balancing to the agent's own Value Profile.

For specific settings of functions Δ, VW, and WDP, the factor ascription mechanism can be non-monotonic across cases. For judges to be consistent, we impose monotonicity: If for a particular case C_1, facts lead to a point on dimension $p_t \in D_x$ ($\delta_{D_x}(C_1) = p_t$) such that an agent ascribes factor F_x ($F_x \in CD$), and in another case C_2 facts lead to point on dimension $p_s \in D_x$ ($\delta_{D_x}(C_2) = p_s$) which is located in the same dimension ($p_t, p_s \in D_x$) but further in the direction of party it favours ($p_s \geq p_t$), then agent a also ascribes factor F_x ($F_x \in CD$).

4. Worked Example

We can now apply our machinery to our example. When we consider a dimension relative to an agent there will be a point, as we move along the dimension in the direction of the party it favours, where the agent will ascribe the factor. It is the *switching point* in [17]. Definition 10 allows us to determine the switching point for each judge, given their value weights as shown in Table 3 and the degrees to which values are promoted or demoted by various points on the dimensions as shown in Tables 1 and 2. Consider *Responsibility*.

- Gibson has weight 3 for *Public Good*, 5 for *Fairness* and 0 for *Enterprise*. Imputed Negligence promotes *Public Good* to degree 2 and demotes *Fairness* to degree -1. For instance, on positive values: $WDP(p_{impNeg}, v_{PG}) * VW(a_{Gibson}, v_{PG}) = 3 * 2 = 6$; on negative values: $WDP(p_{impNeg}, v_F) * VW(a_{Gibson}, v_F = |-1 * 5| = 5$. If we have more positive (negative) values, we would sum the results. In this instance, we ascribe the factor at this point since $6 \geq 5$. But the next point, Not Negligent, promotes *Public Good* to degree 4 while demoting *Fairness* to degree -3. This requires $12 \geq 15$, so Gibson will not ascribe the factor at this point. Thus Gibson starts to ascribe the factor at Imputed Negligence, which is his switching point.
- Traynor has weights 8 for *Public Good* and 4 for *Fairness*. For Traynor the inequality even holds for sabotage by an outsider ($64 \geq 28$). Traynor believes in strict liability and will ascribe the factor even in the most pro-defendant case.
- Ishmael has weights 6 for *Public Good* and 7 for *Fairness*. He will ascribe the factor at Sabotage by Employee ($36 \geq 35$), but not at Sabotage by Outsider (not $48 \geq 49$), making Sabotage by Employee his switching point.
- Freemarket recognises all three values with 2 for *Public Good* and 6 for both *Fairness* and *Enterprise*). This means that he will not ascribe the factor at Proven Negligence (not $14 \geq 24$), but will at Inadequate Safety Procedures ($26 \geq 12$).
- Smallstate does not recognise *Public Good* as a Value, and has weights of 2 and 8 for *Fairness* and *Enterprise*. He will not ascribe the factor at Inadequate Safety measures (not $8 \geq 16$) but will if it was a deliberate act ($16 \geq 8$).

Applying Definition 10 to the factor Damage, with values promoted and demoted to the degrees shown in Table 2 we find that:

- Gibson, Ishmael and Freemarket begin to ascribe the factor at In Transit;
- Traynor begins to ascribe it at After Delivery;
- Smallstate ascribes the factor to any case.

Table 4. Factors Ascribed by Judges. An "*" indicates that the case is at the switching point for that judge.

	Escola	Sabotage	Transit	Careless
Gibson	Responsibility*		Responsibility*, Damage	Responsibility
Traynor	Responsibility	Responsibility	Responsibility	Responsibility
Ishmael	Responsibility	Responsibity*	Responsibility, Damage	Responsibility
Freemarket			Damage*	
Smallstate			Damage	

We can now see how this affects the judges opinions on *Escola* and three hypothetical variants:

- *Sabotage*: In this case the defect was caused by sabotage by an employee.
- *Transit*: Here the damage occurred while the product was in transit.
- *Careless*: Here it was possible to prove negligence on the part of the employer.

The factors ascribed by the judges to the various cases are shown in Table 4.

We now consider how the cases will be decided by these judges.

- *Escola*. This gives a 3-2 verdict for the plaintiff. Both Traynor and Ishmael can join in an opinion in which it is held that negligence is not necessary for a finding for the plaintiff. Gibson, however, cannot join with this verdict since he is already at his switching point. He will thus write a concurring opinion, relying on *Res ipsa loquitur* to impute negligence. Freemarket and Smallstate can join in a dissenting opinion saying that *Res ipsa loquitur* and, *a fortiori*, any stricter liability would stifle Enterprise.
- *Sabotage*. This yields a 3-2 verdict in favour of the defendant. Gibson, Freemarket and Smallstate can all join in an opinion saying that the manufacturer should not be held responsible when it is proven that the defect did not result from the manufacturer's negligence. Traynor and Ishmael will dissent, arguing for strict liability. They may join in an opinion, or Ishmael may write a separate dissent, distinguishing damage caused by an employee from that caused by an outsider.
- *Transit*. This gives a 4-1 decision for the defendant. All but Traynor can join in an opinion which argues that the manufacturer should not be held liable for a defect that occurred after the product had left the manufacturer's control (as in Gibson's opinion is *Escola*, where he explicitly stated that *Res ipsa loquitur* does not apply if it can be shown that the damage occurred after it had left the manufacturers control) Traynor will dissent, arguing for strict liability.
- *Careless*. This is found 3-2 for the plaintiff. Here Gibson, Traynor and Ishhmael could join, since this is, for them, an uncontroversial case where negligence was shown. Both Freemarket and Smallstate would dissent. They would probably choose to write separate opinions, with Smallstate saying that opening the manufacturer to any liability short of a deliberate act would discourage enterprise, whereas Freemarket would argue that a one-off act of negligence was over regulation, and there should be liability only if the defect resulted from a systematic failing such as inadequate safety procedures.

5. Discussion

An important message of this paper is the need to take factor ascription seriously. Current formal accounts of precedential constraint, beginning with [11], take the factors as *givens* and so are unable to account for the kind of disagreement discussed here. Moreover, some precedents constrain factor ascription [6] rather than preferences between factors as in [12] and subsequent accounts. For completeness, formal accounts of precedential constraint need to address factor ascription as well. Also, since the concurring opinions may be used in later cases, these reasons of factors' ascription need to be represented as well as the reasons for the outcome.

This paper has introduced a mechanism of *switching point*, whereby a factor can be associated with a case relative to a judge's values. We have not represented this as an argumentation scheme or integrated it into factor argumentation schemes of [8]. It is for future work to formalise notions of "sufficiently close" and "much more favourable" as well as to explain why there may be precedents with the same dimension point but in which the factor did not apply, because of different values of the judge in that case.

It is interesting to note an asymmetry in the disagreements. If one judge is at his/her switching point and another is not, the former will think the latter is wrong, whereas the latter will concur with the former, while believing that his/her interpretation does not go far enough. For instance, if Traynor writes the majority in *Escola* relying on strict liability, which Gibson rejects, Gibson must write a concurring decision. On the other hand, if Gibson writes the majority, since Traynor does accept imputed negligence, he *could* join with Gibson. However, if he wants to emphasise that it is not necessary to impute negligence, he can do so in a concurring decision, to suggest that strict liability is the "real" reason to find for the plaintiff. If a judge has a switching point giving a broader interpretation of the factor, he can choose to accept an opinion using the narrower interpretation or explicitly contest the narrowness of that interpretation.

6. Concluding Remarks

This paper presents a formal mechanism which explains why and how different judges ascribe different factors on the basis of the same facts. Although the importance of values in explaining the judges' decisions has been discussed since [9], these models only explain how values establish preferences between arguments. Our work focuses on more fundamental issues: why judges differ even at the level of factor ascription, and why judges, even if they agree about the outcome, can provide a different justifications, which do not necessarily attack each other. Our model also extends the initial approach presented in [20] by balancing values.

Another advantage of our model is the possibility of the analysis of hypothetical cases. Knowing the agent's attitude towards values we can analyse and predict not only judges' votes, but also a justification they might deliver.

As pointed out in Section 1, Perelman [15] provided a typology of disagreements Previous work [9, 7, 3] developed analyses relative to the "ends", where an argument was accepted (rejected) as a whole relative to an agent's values. In this paper, we have developed an analysis of the "interpretation and characterisation of facts", where factors are attributed to a case relative to an agent's values. The two approaches are complementary, showing different approaches to the application of values in reasoning.

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