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On Legal Teleological Reasoning

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Abstract. Given a common pool of facts and legal rules, Judges on a panel may form different justifications for decisions, which are then voted upon. It is clear that a Judge's personal values and purposes play in developing their opinion, which is a form of teleological reasoning. The paper introduces the Value-based Formal Reasoning (VFR) framework, which describes how a Judge's personal values can be used in the construction of a justification for a decision.

Keywords. Values, Knowledge-base, Argumentation, Agents

1. Introduction

In AI and Law research, case factors and values are indirectly related via the decision of which they are a part [1,2,3]. However, this line of analysis misses the relation between factors and values. Without a relation, the factors of a case could vary without a correlated variation between decisions and values; or alternatively, given a fixed set of factors, different Judges might interpret the same decision to promote different (antithetical) values. Yet, it appears that Judges infer and agree on correlations amongst factors, decisions, and purposes, as otherwise there would be greater variation on decisions. This is a significant problem which has as not been addressed. The analytic framework we develop is a contribution towards investigating and providing such an explanation.

On the other hand, Judges differ in their opinions, as in evidence in U.S. Supreme Court panels. Why and how does such variation arise? After all, faced with one body of laws and facts, one might expect Justices to converge on the justification and decision? [4] points out that personal preferences of Judges are more prominent in higher court decisions than in lower courts; [5] finds empirical evidence of personal values in decisions. Previous research does not address how instantiated arguments are constructed relative to a Judge and their values, though it does address how extensions are provided in abstract argumentation relative to audiences [6].

The aim of the research is to fill in missing links between: *the facts of a case and the values associated with the instantiated argument and decision*; and *a Judge's argument constructed from a common pool of facts and legal rules relative to the Judge's values.* We propose a formal framework for Value-based Formal Reasoning (VFR), which treats values as a key means by which a Judge creates her argument.

The proposal is scoped, leaving a range of topics for future development. We are only concerned with the construction of justifications for a decision (instantiated argu-

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ments), rather than the evaluation of arguments as in abstract argumentation frameworks. The framework provides an analytic, descriptive model of the behaviour of judges.

Sections 2 and 4 provide a framework of basic predicates, filters, knowledge bases, and reasoning chains (an agnostic approach to structured argumentation)[2]. Sections 3 and 5 are a worked example. We discuss related work in Section 6, then conclude.

2. Agents, Propositions, Values, and Weights

A language is used for knowledge bases and reasoning in Section 4. We assume:

- `Agent`, where each element is an agentive entity.
- `Prop`, where each element is a proposition.[3]
- `IncompProp` is of type `Prop` × `Prop`, where for every pair <x,y> of distinct elements of type `Prop`, x and y cannot co-occur in any set. The relation is symmetric. The expressions of such a pair are called *objectively incompatible*.
- `Value`, where each element of `Value` is an abstract object that expresses a value concept such as *freedom*, *security*, etc.
- `Scale`, which is a totally ordered, finite set of scalar elements.
- `Weight` is of type `Scale` | ?. The question mark "?" indicates that a weight is indeterminate (not relevant).[4] While there may be alternative interpretations of 'weights', here they reflect the relative 'importance' to an agent. Given that ? lies outside the order of the other weights, any proposition which is assigned value ? passes an agent's filter.

With the following definitions, we construct $\texttt{PropBaseClean}_{agent_h}$, which represents all and only those `Prop` that are compatible with the values of agent_h. The definitions can articulate alternative `PropBaseCleans`.

An Agent's *value profile*, `AgentValueToWeight`, indicates the degree of importance that the Agent ascribes to a Value, where the higher the weight, the more important and the lower the weight the less important.

$$\texttt{AgentValueToWeight} = (\texttt{Agent} \times \texttt{Value}) \rightarrow \texttt{Weight}$$

An Agent's value profile bears a subscript, e.g., $\texttt{AgentValueToWeight}_{agent_k}$ for agent agent_k. Given the ? weight, the importance an Agent associates with a Value can be indeterminate. Any two agents may ascribe different weights to the same value.

An agent assesses an element of type `Prop` with respect to an element of type `Value` and an element of type `Weight` with a total function:

$$\texttt{AgentValuePropWeight}\colon (\texttt{Agent} \times \texttt{Value} \times \texttt{Prop}) \rightarrow \texttt{Weight}$$

This expresses an agent's disposition towards a Prop with respect to Values and Weights. While `AgentValuePropWeight` is a total function, the use of ? signals that there may be Props which are not meaningfully assessed. The association of a proposition with a particular value and weight is resembles approaches in [8] and [9].

To reflect an Agent's value-based *world view*, we gather all the Props that are "compatible" with an Agent's values. In VFR, this means that the Weight an Agent assigns to a

[2] A prior version of some of the formal framework has appeared in [7] and the AICOL 2022 Workshop

[3] This is a simplification. Props could be Prolog atoms. Truth-conditions are not germane.

[4] Propositions might be neutral with respect to values.

proposition relative to a Value must not be less than the Weight that Agent assigns to that Value in their profile. However, Props can be indeterminate with respect to the Weight on Values. Given ? is unordered with respect to weights, such a proposition always passes an agent's filter. A set $\texttt{PropBaseClean}_{agent_h}$ contains all and only those Props which pass the value-weight in the value profile for agent_h for all values.

> PropBaseClean is of type Prop.[5]
> Where $agent_\alpha$ is a variable for elements of type Agent, p_β is a variable for elements of type Prop, and v_γ is a variable for elements of type Value, the denotation relative to an $agent_\alpha$ is:
> $\texttt{PropBaseClean}_{agent_\alpha} = \{p_\beta | \neg(\texttt{AgentValuePropWeight}(agent_\alpha, v_\gamma, p_\beta) < \texttt{AgentValueToWeight}(agent_\alpha, v_\gamma))\}$

This is a strict, formally convenient definition, which assesses all Props and creates a set of only those Props that pass the agent's value filter. In future work, we develop more lenient, flexible definitions. Any set of PropBaseClean may contain incompatible propositions. Moreover, two agents may each accept the same proposition, yet for different settings of values and weights.

3. Example - Escola vs Coca-Cola Bottling Co. - Part 1

The running example is *Escola vs Coca-Cola Bottling Co.*, a U.S. Supreme Court opinion (24 Cal.2d 453, 150 P.2d 436 (1944)) [6] Plaintiff Gladys Escola was a waitress in a restaurant. She was putting away glass bottles of Coca-Cola when one of the bottles spontaneously exploded in her hand. She suffered a deep five-inch cut.

Chief Justice Phil S. Gibson gave the majority opinion for the plaintiff, since though the bottle was not under the exclusive control of the defendant at the time of the incident, the defendent had control at the time the alleged negligent act took place (bottle filling).

Justice Roger Traynor issued a concurring opinion, but argued instead that a strict liability rule should be imposed on manufacturers whose products cause injury to consumers. Note that although majority and concurring opinions are distinct, they are not attacking each other and are not necessarily in contradiction.

Modeling There are 3 Judges = {Agent_A, Agent_B, and Agent_D} and 6 propositions:

- *Liab* – a manufacturer of goods is responsible for their quality
- *manPrep* – manufacturers are better prepared to handle the costs of injury
- *NoDam* – no damage after delivery
- *defContr* – defendant had control at the time the alleged negligent act took place.
- *Compensate* – The manufacturer should compensate the harm
- *notCompensate* – The manufacturer do not have to compensate the harm

We have two values: *resp* – individual responsibility and *pubGood* – public good. For AgentValueToWeight, we initially narrow down the example to 2 Judges, 3 Props, and 2 values:
$\texttt{AgentValueToWeight}(Agent_A, resp) = 3;$
$\texttt{AgentValueToWeight}(Agent_A, pubGood) = 1;$

[5] We indicate variables with Greek subscripts and constants with Latin subscripts.
[6] https://www.courtlistener.com/opinion/1210011/escola-v-coca-cola-bottling-co/?q=escola%20vs%20coca%20cola

$\texttt{AgentValueToWeight}(Agent_B, resp) = 2$;
$\texttt{AgentValueToWeight}(Agent_B, pubGood) = 3$.
Agent_A has high requirements concerning responsibility and low requirements concerning public good, while Judge_B is different. The AgentValuePropWeights for Judges are presented in Table 1 (Props in an Agent's propBaseClean are in bold).

Table 1. AgentValuePropWeight for $Agent_A$ and $Agent_B$

Agent	**Propositions**	**Values**	**Weight**	**Agent**	**Propositions**	**Values**	**Weight**
Agent_A	manPrep	resp	1	$\mathbf{Agent_B}$	**manPrep**	**resp**	**2**
Agent_A	manPrep	pubGood	2	$\mathbf{Agent_B}$	**manPrep**	**pubGood**	**3**
$\mathbf{Agent_A}$	**defContr**	**resp**	**3**	Agent_B	defContr	resp	3
$\mathbf{Agent_A}$	**defContr**	**pubGood**	**2**	Agent_B	defContr	pubGood	1
$\mathbf{Agent_A}$	**Compensate**	**resp**	**3**	$\mathbf{Agent_B}$	**Compensate**	**resp**	**3**
$\mathbf{Agent_A}$	**Compensate**	**pubGood**	**2**	$\mathbf{Agent_B}$	**Compensate**	**pubGood**	**3**

As both Judges accept *Compensate*, they can vote for the same decision. For each Judge, the PropBaseClean is: $PropBaseClean_{Agent_A} = \{defContr, Compensate\}$ and $PropBaseClean_{Agent_B} = \{manPrep, Compensate\}$.

4. Subjective Knowledge Bases

Given PropBaseClean, we construct knowledge bases and arguments relativised to an Agent and their Values.

Definition 1 (Rules) *We assume Definite Horn clauses in the implicative form (rules), where the antecedents and conclusion of each rule are of type Prop. We assume a set of labels for rules $\mathscr{R}$; as a shorthand, the labels stand in for the rules. We can alternatively represent rules as ordered pairs $< \mathscr{P}, \mathscr{C} >$, where $\mathscr{P}$ is a set of premises and $\mathscr{C}$ a singleton conclusion.*

Definition 2 (Subjective Knowledge Base) *Given a set of atomic propositions P_i of type Prop, a set of rules $R_j \subseteq \mathscr{R}$, and an $Agent_A$, a subjective knowledge base $KB_{\,Agent_A}$ is $< P_i, R_j >$ where $\forall_{p_\alpha s.t. P_i \cup R_j \vdash p_\alpha}(p_\alpha \in PropBaseClean_{agent_A})$*

A subjective knowledge base represents what an Agent *accepts* relative to their values. A subjective knowledge base can be inconsistent, as in argumentation theory [10,11]. To be agnostic theories, we define *Reasoning Chains* in subjective knowledge bases.

Definition 3 (Subjective Reasoning Chain) *Given a subjective knowledge base $KB_{Agent_A} = < P_{Agent_A}, R_{Agent_A} >$ and a reasoning chain $RC^j_{Agent_A}$ as $<KB^j_{Agent_A}, p_j>$, where $KB^j_{Agent_A} = <P^j_{Agent_A}, R^j_{Agent_A}>$, $P^j_{Agent_A} \subseteq P_{Agent_A}, R^j_{Agent_A} \subseteq R_{Agent_A}$:*

1. *Every proposition derived from $RC^j_{Agent_A}$ should be in $PropBaseClean_{Agent_A}$:*
   $\forall_{p_\alpha s.t. RC^j_{Agent_A} \vdash p_\alpha}(p_\alpha \in PropBaseClean_{Agent_A})$
2. *$KB^j_{Agent_A}$ is a set of atomic propositions and rules which are necessary to derive p_j (conclusion);*
3. *$KB^j_{Agent_A}$ does not contain cycles;*

4. $\neg(\exists_{p_\gamma,p_\delta}$ s.t. $KB^j_{Agent_A} \vdash p_\gamma$ and $KB^j_{Agent_A} \vdash p_\delta$ and $< p_\gamma, p_\delta > \in incompProp)$.

A reasoning chain must be *internally* consistent. Reasoning chains constructed with respect to a subjective knowledge base is, in some sense, principled and in comparison to reasoning chains constructed without reference to a subjective knowledge base.

5. Example - Escola vs Coca-Cola Bottling Co. - Part 2

Here we present how to model the process of reasoning of Judges with issuing a Court decision. As a starting point we take `propBaseClean` of each Judge. In the example of Section 3 we presented a simplified version for a PropBaseClean derived from a Judge's value profile. Below we present the more complex example with 3 Judges and 6 propositions to demonstrate a distribution of opinions, including a concurring opinion:
`Prop` = $\{Liab, manPrep, NoDam, defContr, Compensate, Reject\}$
Objectively incompatible propositions: $< Compensate, Reject > \in$ `IncompProp`.
PropBaseCleans for each Judge:
$\texttt{PropBaseClean}_{Agent_A} = \{NoDam, defContr, Compensate\}$
$\texttt{PropBaseClean}_{Agent_B} = \{NoDam, defContr, Compensate\}$
$\texttt{PropBaseClean}_{Agent_D} = \{Liab, menPrep, Compensate\}$
Rules: $NoDam, defContr \rightarrow Compensate$; $Liab, menPrep \rightarrow Compensate$
Subjective reasoning chains of all Judges:
$RC_{Agent_A} = << \{NoDam, defContr\}, NoDam, defContr \rightarrow Compensate >, Compensate >$
$RC_{Agent_B} = << \{NoDam, defContr\}, NoDam, defContr \rightarrow Compensate >, Compensate >$
$RC_{Agent_D} = << \{Liab, menPrep\}, Liab, menPrep \rightarrow Compensate >, Compensate >$
Note that every proposition used in a particular Judge's chain is in his propBaseClean.
Observations:
Agent_A and Agent_B create the same chains constituting $Consortium_{\gamma,Compensate}$, where $\gamma =< \{NoDam, defContr\}, NoDam, defContr \rightarrow Compensate >$.
Similarly, chain of Agent_D constitutes $Consortium_{\delta,Compensate}$, where $\delta =< \{Liab, menPrep\}, Liab, menPrep \rightarrow Compensate >, Compensate >$.

The Judges (Agents) agree on the final conclusion, but have different justifications. Moreover, neither justification attacks the other because propositions in the justifications do not exclude each other. Since values should be satisfied in justifications and conclusions, VFR allows for individual, value-based, teleological constructions. Thus, Judges can provide the same opinion, but on the basis of different values.[7]

6. Discussion and Conclusion

Most of the papers on teleological reasoning [1,12,13,14,15] use values to justify preferences rather than formulate judges opinions. Moreover, the models do not include the subjective motivation of a Judge. VFR has some aspects in common with [16], e.g., thresholds to represent goals of agents and the assignment values to conditions of rules.

VFR is related to computational argumentation, though with different aims. Firstly, unlike [17,18] and instantiated argumentation frameworks [11,10], the model does not

[7] See [7] for related discussion.

find "winning" and defeated arguments, semantics, etc., but rather explains why and how agents (Judges) construct instantiated arguments. In abstract argumentation such as VAF [17], the internal structure of an argument is not analysed.

The paper presents a novel, formal framework for teleological reasoning to model the mechanism of creation of justifications for a conclusion in a panel of Judges (Agents). In VFR, the values of an Agent are key to creating an Agent's knowledge base and thence justifications. The locus of values are taken to be propositions. Our model explains how, given shared information, Agents select information and create different (possibly, but not necessarily attacking) justifications on the basis of their different value profiles.

In contrast to existing approaches to model teleological reasoning, the model is descriptive; it does not model the behavior of an *ideal* Judge or prescribes how Judges should reason Such a model can be seen as a formal background for the analytical research allowing for better understanding the purposes of the decisions Judges make.

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