

Arguing from a Point of View^{*}

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Abstract. Evaluative statements, where some entity has a qualitative attribute, appear widespread in blogs, political discussions, and consumer websites. Such expressions can occur in *argumentative settings*, where they are the conclusion of an argument. Whether the argument holds depends on the premises that express a user's point of view. Where different users disagree, arguments may arise. There are several ways to represent users, e.g. by values and other parameters. The paper proposes models and argumentation schemes for evaluative expressions, where the arguments and attacks between arguments are relative to a user's model.

1 Introduction

People argue, making statements, providing justifications, and criticising the statements or inferences of others. Arguments appear in a great range of contexts - blogs, political discussions, and consumer websites, among others. Some statements in the arguments have an *objective* meaning, in the sense that there is or can be high agreement between individuals, e.g. bearing on the time of day, someone's height, or the number of people in a car; other statements are more *subjective* in that their meaning is grounded in individual judgement. For example, a statement such as *The hotel is in an excellent location* said by a travel agent to a client, giving several statements as justification. One client may agree that the location is excellent, depending on his point of view, knowledge, or values; the client accepts the travel agent's argument. Yet, another user may disagree from her point of view. In general, there can be arguments about the evaluative expression relative to a user model. The paper presents a proposal for treating such user-relative evaluative arguments. The key point is to show how we can explain arguments over evaluative expressions using instantiated argumentation schemes relative to a user and a domain model.

Let us consider a use case and example to clarify the point. Suppose a travel agent and two individuals, Jill and Bill, who are consulting the travel agent. Bill goes to the agent, says he is going to a conference in Valencia, gives the address of the venue, and asks the agent to find accommodations. The travel agent consults the accommodation database, finds *Hotel Valencina* and says *Hotel Valencina is in an excellent location*. Bill, being an active consumer, inquires *Why?* in order to find out what justification there is for making the statement, to which the agent replies *The hotel is a mile from*

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the conference venue and *The hotel is in the old part of the city*, where the conference center is a relevant location to the interlocutor. In effect, the agent has presented an argument to Bill that justifies the evaluative expression: *Where the hotel is a mile from the (relevant) conference venue, and the hotel is in the old part of the city, so therefore, the hotel is in an excellent location*. If Bill accepts the premises, he may accept the conclusion as well, so book the hotel. In contrast, Jill consults the same agent and is presented with the same argument, but does not accept the conclusion of the argument, so asks for something else. There may be a range of aspects that Jill disagrees with. She may claim: that the hotel is not, as the agent claims, a mile from the venue, but is several miles; or that while it is in the old city, it is in the bad part; or that *The hotel is located near a noisy, busy road*; or that she agrees that the Valencia Hotel is one mile from the conference venue and is in the old part of the city, yet *disagrees* that it is in an excellent location since those justifications are not sufficient for her to agree that it is in an excellent location. For Jill, an excellent location is quiet, less than a mile from the venue, includes parking facilities, and is convenient to good restaurants and shops.

This use case and example highlights several aspects that could be addressed. There can be dialogue between the agent and client of different sorts, e.g. information seeking or persuasive [1]; the agents Jill and Bill might seek to agree on which hotel to book, so engage in dialogue between them. For the purposes of this paper, we abstract from dialogical or consensual aspects to focus on the static meaning of the statements and argument with respect to a singular user, which underpins the dialogical or consensual uses. Dynamic, dialogical aspects are, for our purposes, a *side effect of linguistic linearity*. In the example above, the travel agent claims that Hotel Valencina is in an excellent location for the client given what the travel agent knows or presumes about the client. Where differences arise, the client claims that the travel agent has incorrect knowledge of the client. The client's statements correct the travel agent's knowledge, which revises the travel agent's offering to the client.

To account for user-relative arguments for evaluative statements, we develop several subcomponents. First, we have a proposal about the various aspects of a domain that are relevant in the construction of the arguments, in effect, the knowledge base of the domain. To keep the discussion grounded, we discuss the travel agent setting. Second, we identify the sorts of arguments that can be made in this domain, and in particular, the relationships between premises and conclusions since there appear to be patterns, e.g. argumentation schemes [2], of reasoning. Such arguments signal that evaluative statements are *intermediate concepts*; the justifying premises may be base level concepts, which are found in the knowledge base rather than given by rule, or themselves further justified by rule [3]. To identify attacks, we must state incompatibilities in the knowledge base. In addition, we must define user models with respect to the knowledge base. In brief, the argument between the travel agent and a client is about any differences between the travel agent's representation of the knowledge base of the client and the client's knowledge base about herself; the arguments then just reflect the difference.

The novelty of the paper is in the development of user-relative arguments to justify evaluative statements. The rest of the paper develops these points. Section 2 elaborates on the use case, identifies elements to focus on in the user models, specifies the argumentation schemes, and provides sample user models. Section 3 introduces the Logic-

based argumentation style approach, which has arguments constructed from knowledge bases. With respect to this, we develop user models as knowledge bases from which user-relative arguments can be produced. In Section 4 we review related work and we close out the paper with future work in Section 5.

2 Use Case, Domain Model, Argumentation Schemes, and User Models

In this section, we develop the use case, the terms for a domain model, the argumentation schemes, and informal user models. In each subsection, we provide a sample of the relevant information and the relationships between them.

2.1 Use Case

We assume a travel agent and two different clients, *Jill* and *Bill*. The clients are going to a conference in a city, where the conference venue has a fixed location. The conference offers a discount on a selected range of hotels, and the clients select only from amongst these hotels. The hotels provide information about their rating, cost, amenities, location, and whatever other aspects they deem relevant such as values along the lines of *family friendly*. This information is represented in the knowledge base. In addition to the information given by the hotels, the travel agent may have auxiliary information about the hotels based on first hand experience or reports from other clients such as staff conduct, cleanliness, noise, and others. The clients have access to the hotel's information and auxiliary information such as derived from travel websites. Importantly, clients specify their preferences with respect to this information, for example, preferring locations at certain distances, parts of city in which the hotel is found, amenities, and so on. For each of the clients, the information may be partial, though for the purposes of our study here, we may presume the information to be total.

2.2 Domain Model - Hotel Features and Evaluation

We provide a sample selection of the various elements that can be used to represent the hotel and the claims about it; there may be alternative representations of the hotel features, and we make no pretense that these are sufficient features correctly organised, though they seem plausible.

Hotel Features

- Local Venues: conference centre, harbour, museum,
- Distance: 100 meters, 1000 meters, 2000 meters, 5000 meters,
- Cost: 50 euros, 90 euros, 150 euros,
- Affiliation: hotel chain, independent,
- Rating: 5 star, 4 star, 3 star,
- Availability of rooms: many available, few available, none available,
- Amenities: fitness center, pool, sauna, bar, meeting rooms, laundry service, non-smoking, smoking, free wireless in-room internet access, inclusive of breakfast, free garage parking, bicycle rental,

- Condition of hotel: new, character, antique, well-maintained, ramshackle,
- Location in city: old city centre, near beach, new city area,
- Values: family friendly, business-oriented, traveler-oriented,
- Room type and facilities: noise, air conditioning, internet in room, TV, cable, desk, phone
- Hotel Provisions: lobby, social spaces, bulletin message boards, concierge, tourist information, ...
- Auxiliary information: friendly staff, professional staff, not clean, very clean, quality breakfast, simple breakfast,

Each of these can be expressed propositionally such as in *Distance from relevant venue is 100 meters*. Propositional negation indicates explicit semantic contrast as in *There is free wireless in-room internet access* versus *There is no free wireless in-room internet access* (or alternatively *Wireless in-room internet access costs 5 euros per 24 hours*). Different scalar values such as cost and rating are presumed to be incompatible. Locations are also assumed to be incompatible (e.g. the city centre is not near the beach).

Besides what we may take as base level concepts, we have higher level concepts that are defined in terms of the base level concepts. We distinguish the evaluative adjective and the nominal term:

Evaluative Expressions

- Evaluative adjective: excellent, adequate, poor,
- Nominal term: location, quality, value-for-money,

To create schemes below, we want expressions of hotel features with variables that can be grounded. *A*, ..., *Z* are variables over the relevant domain (e.g. *C* ranges over hotel affiliations).³ These are given for both Hotel Features and Evaluative Expressions.

Hotel Feature Statements with Variables

- The distance from venue *A* is *B*.
- The affiliation of the hotel is *C*.
- The rating of the hotel is *D*.
- The hotel has *E* rooms available.
- The hotel has amenity *F_i*.
- The condition of the hotel is *G*.
- The location of the hotel is *H*.
- The hotel upholds a *I* value.
- The hotel has *J_i*, known from independent information.

The conclusions of arguments with evaluative expressions have a schematic form:

Evaluative Statements with Variables

- The hotel is *K L*, where *K* is an evaluative adjective and *L* a nominal term.⁴

³ Where we have one more than one instantiation of a variable, e.g. *F* and *J*, we indicate this with a separate proposition and a different value of a variable.

⁴ We assume some syntactic simplification to overlook differences such as the prepositions and determiners in *The hotel is in an excellent location* and *The hotel is poor value for money*.

The objective is, then, to tie the hotel features to the evaluation such that the features are used to justify the evaluation. This then needs to be associated with different clients, representing different points of view.

2.3 Argumentation Schemes

To argue about the evaluative statements relative to statements of the domain model, we introduce Argumentation Schemes, which are stereotypical patterns of defeasible reasoning [2]. While a range of patterns are catalogued, there is no definition of the necessary and sufficient conditions for them, and specialised schemes can be constructed to suit arguments in a domain [4,5]. On the other hand, some more general specification can be given [?]. For the purpose of this paper, we have used a very simple presentation of argumentation schemes, representing them as premises and a rule from which a presumptive conclusion follows, leaving aside different classes of premises and exceptions; in this respect, argumentation schemes are like the inference rules of Propositional or Predicate Logic, though with presumptive conclusions. Though schemes are underdetermined, some of the relevant aspects of schemes can be identified, and not just any premise can serve to argue for any conclusion. We give two schemes, one for location and another for quality. Clearly, where one is arguing about location, then only premises that might bear on location ought to appear, and similarly for quality; in other words, premises about cost do not seem relevant to arguments about location, and premises about the number of rooms available do not seem relevant to arguments about quality. Moreover, the schemes are given abstractly, for the crucial issue is just how to instantiate the variables in such a way as to give different and (perhaps) incompatible justifications for evaluative expressions. We have given the rule in a generic form since the pattern holds for all schemes - the premises of the scheme imply the conclusion of the scheme. As with any argumentation scheme, arguments can be attacked on their premises, rule, or conclusion by a proposition that is the negation of the proposition in the scheme. For clarity, we have made relevant premises explicit. It is possible that some of the premises could be left implicit or that there are premises implicit in the schemes that ought to be made explicit. *Enthymemes* in argumentation is a significant research area that we do not explore further [6,7].

Evaluation of Location Argumentation Scheme (EL)

- Premise: The distance from venue A is B .
- Premise: The location of the hotel is H .
- Premise: The hotel has J_i , known from independent information.
- Rule: If Premises, then Presumptive conclusion.
- Presumptive conclusion: Therefore, the hotel is K location.

Evaluation of Quality Argumentation Scheme (EQ)

- Premise: The rating of the hotel is D .
- Premise: The hotel has amenity F_i .
- Premise: The condition of the hotel is G .
- Premise: The hotel upholds a I value.
- Premise: The hotel has J_i , known from independent information.

- Rule: If Premises, then Presumptive conclusion.
- Presumptive conclusion: Therefore, the hotel is M quality.

The issue then reduces to the problem: given values for variables in the premises, what value for the variable in the conclusion holds? As underdetermined schemes, there may not be precise boundaries around the values. In addition, the premises themselves may need further argumentative support. Yet, there are reasonable parameters: for example, if a hotel is 100 miles from the relevant venue, located in a deserted industrial zone, and inaccessible to transportation, it is unlikely that such a hotel would be judged in an excellent location; similarly, if all the premises of the quality scheme are highly negative (one star, no amenities, poor condition, and upholds neo-Nazi values), it is improbable that one would infer that hotel is of adequate quality (unless one were a neo-Nazi, which illustrates the point of our paper, namely that justifications for evaluative expressions depend on the user). As these are *defeasible* argumentation, the operative words are *unlikely* and *improbable* as there may be individuals for whom the inference follows. On the other hand, there may be alternative ways to argue for a particular conclusion: a hotel may be deemed in an excellent location if it is within a kilometer of the designated venue and either in the old city centre or near the beach. This shows that the determinative premise is just the distance from the venue and that the location in the city is not relevant.

2.4 User Models

With respect to the hotel features, we can describe user models. For our purposes, a user model, what we call the *hotel user model*, is a representation of the desirable attributes for the hotel for a user. Alternatively, a user model might be a representation of the attributes of the user *per se*, which we call the *person user model*. We first discuss the latter, then return to the former.

For the person user models, we can identify classes of individuals by their properties that contribute not only to substance of the user's preferences, but as well to how they react to the agent's suggestions.

- User's parameters: Age, gender, nationality, income, education, previous travel experience, and so on.
- User's context of use: Dates, purpose of trip, and so on.
- User's constraints: Cost, size, richness or flexibility of features, and so on.

From the properties above, we could form classes of users such as business traveller, budget traveller, tourist, luxury vacationer. These classes describe certain types of likely needs and preferences. For instance, a business traveller may insist on high speed wireless and a desk, while a budget traveller may forego these and other amenities in order to cut costs. In either case, the person user models correspond to classes of individuals similarly described, though here we do not discuss this point further.

The hotel user model may correlate with the person user model in the sense that the attributes of one imply a classification as the other, meaning that an individual who is male, from the USA, with a six-digit income, and advanced degrees might correlate with a hotel user model in which the hotel costs 150 euros per night, is 5 star, and has all

the amenities, whereas an individual who is male, from England, with a low five-digit income, and no advanced education might correlate with a hotel user model in which the hotel costs 50 euros, is far from the relevant venue, and has a low rating. Such correlations, though they may exist, are not central to our discussion since we consider arguments about the hotel given the user's desired features.

The objective of creating a hotel user model is not just to indicate what the user wants, but how the attributes are used to argue for an evaluation with respect to hotels, that is, to argue for whether a hotel is, in the view of the user, *excellent*, *adequate*, or *poor* in some respect or another. There are alternative ways to create the hotel user models. For example, we could construct an ontology where hotel features and evaluations are associated with classes and subclasses of individuals, these being the sorts of features a class of individuals use to reason towards an evaluation about a hotel. A more complex and potentially interesting approach is to use aspects of case-based reasoning, for individuals may reason for and against a particular conclusion by counterbalancing various features one against the other as one would in a legal case [4]. A user may have alternative ways to draw the same evaluation. Nor do we consider dynamic user models, where the values of attributes might change over time in response to new information. All such approaches we leave for future work since they are derived from the approach in this paper - how instantiated argumentation schemes relative to a user and a domain model represent arguments over evaluative expressions.

A user is represented as the set of grounded propositions for the premises, rule, and presumptive conclusion of the argumentation schemes for Evaluation of Location and Quality. After all, we are only representing the knowledge base of the users from which the argumentation schemes are constructed. To emphasise our essential point, we suppose that the users have but one way to instantiate the propositions.

Model of Bill, Instantiating EL

- Premise: The distance from venue *conference centre* is *2000 meters*.
- Premise: The location of the hotel is *old city centre*.
- Rule: If Premises, then Presumptive conclusion.
- Presumptive conclusion: Therefore, the hotel is *in an excellent* location.

Model of Bill, Instantiating EQ

- Premise: The rating of the hotel is *3 star*.
- Premise: The hotel has amenity *wireless in-room internet access costs 5 euros per 24 hours*.
- Premise: The condition of the hotel is *ramshackle*.
- Premise: The hotel upholds a *traveler-oriented* value.
- Premise: The hotel has *friendly staff*.
- Premise: The hotel has *some quiet rooms*.
- Rule: If Premises, then Presumptive conclusion.
- Presumptive conclusion: Therefore, the hotel is *of adequate* quality.

Model of Jill, Instantiating EL

- Premise: The distance from venue *conference centre* is *500 meters*.
- Premise: The location of the hotel is *new city area*.
- Rule: If Premises, then Presumptive conclusion.

- Presumptive conclusion: Therefore, the hotel is *in an excellent* location.

Model of Jill, Instantiating EQ

- Premise: The rating of the hotel is *4 star*.
- Premise: The hotel has amenity *free wireless in-room internet access*.
- Premise: The condition of the hotel is *well-maintained*.
- Premise: The hotel upholds a *business-oriented* value.
- Premise: The hotel has *professional staff*.
- Premise: The hotel has *only quiet rooms*.
- Rule: If Premises, then Presumptive conclusion.
- Presumptive conclusion: Therefore, the hotel is *of adequate* quality.

We see here that though the conclusions are the same in each of the models, but *the specific propositions that are used to justify them are not just different, but incompatible*.

Returning to our use case involving a travel agent. Suppose that the travel agent is discussing a hotel reservation with Jill as the client, but makes statements based on a hotel user model such as represented for Bill. The travel agent asserts about a particular hotel: *The hotel is in an excellent location*. Jill asks for a justification, which again is given relative to the hotel user model such as for Bill: *The distance from the venue conference centre is 2000 meters* and *The location of the hotel is old city centre*. However, such justifications are not compatible with the hotel user model for Jill, which requires that for a hotel to be in an excellent location, it must be closer to the conference venue and in the new city area. In other words, the proposed hotel is not, relative to Jill's hotel user model, in an excellent location. Similarly, the adequacy of the hotels differ.

Of course, a quality travel agent would either know (from prior experience with the client) what criteria the particular client has and her evaluative conclusion or (having no prior experience) ask a series of investigative questions to determine them. Yet, in the absence of complete knowledge of the hotel user or the requisite components of reasoning to the conclusion, differences in evaluation may arise, leading to the sorts of differences we see above.

3 Towards a Formalisation

In this section, we provide a formalisation of the observations above using the *logic-based* approach of [8,9], which represents arguments in terms of classical logic. For our purposes, this provides a relatively straightforward way to represent users in terms of knowledge bases and arguments in terms of those knowledge bases (for alternatives see ([10,11,12,13,14,15])). While we could discuss other approaches to instantiating arguments and relationships which use defeasible rules (e.g. [14,16]), we keep to a logic-based approach for several reasons: it is founded in a well-known and widely used logic (classical propositional logic), it has an extension to First-order Logic, and issues about generating and structuring arguments in relations are well-developed (e.g. minimal arguments, redundancy, and argument tree pruning among others). However, as we are primarily interested to explore an implemented example, we do not examine these issues further.

The main idea is that we can create user indexed knowledge bases from which arguments are created. A user may dispute an argument that is created with propositions that are inconsistent with her knowledge base. The user isn't rejecting the argument *per se* as altogether wrong for all individuals, but rejecting the argument as one that she in particular agrees with. Let's call this first person defense since at some point we bottom out the analysis in self-attributed knowledge, which we need not ascribe any intrinsic *truth* to. Moreover, we can argue about whether or not something holds relative to the user model. In the following, we first briefly introduce logic-based argumentation, then the user indexed approach.

In a logic-based approach, statements are expressed as atoms (lower case roman letters), while formulae (greek letters) are constructed using the logical connectives of conjunction, disjunction, negation, and implication. The classical consequence relation is denoted by \vdash . Given a knowledge base Δ comprised of formulae and a formula α , $\Delta \vdash \alpha$ denotes that Δ entails α . Δ can be inconsistent and comprised of a range of declarative statements. We assume a set of formulae Δ from which arguments are constructed. Where \perp denotes inconsistency, $\Delta \vdash \perp$ denotes that Δ is inconsistent. An argument is an ordered pair $\langle \phi, \alpha \rangle$, where $\phi \subseteq \Delta$, ϕ is a minimal set of formulae such that $\phi \vdash \alpha$, and $\phi \not\vdash \perp$. ϕ is said to support the claim α . For example, where p and q are atoms, and where the KB is comprised of p and $p \rightarrow q$, then $\langle \{p, p \rightarrow q\}, q \rangle$ is an argument, where $p, p \rightarrow q$ is the support for the claim q .

The knowledge base Δ may be inconsistent, which here arises where Δ contains contradictory propositions (and not necessarily just constraints). With contradictory propositions, we can construct arguments in relations, where the propositional claim of an argument is contradictory to the propositional claim of another argument or is contradictory to some proposition in the support of another argument. These are *attack* relations between arguments $\langle \Psi, \beta \rangle$ and $\langle \Phi, \alpha \rangle$ such as *undercutter* and *rebuttal*; attacking arguments are referred to as *counterarguments*. $\langle \Psi, \beta \rangle$ is an undercutter for $\langle \Phi, \alpha \rangle$ where β is $\neg(\phi_1 \wedge \dots \wedge \phi_n)$ and $\{\phi_1 \dots \phi_n\} \subseteq \Phi$; in essence, the claim of one argument is the negation of a set of formulae in the support of another argument.⁵ $\langle \Psi, \beta \rangle$ is a rebuttal for $\langle \Phi, \alpha \rangle$ if and only if $\beta \leftrightarrow \neg\alpha$ is a tautology; the claims of the arguments are inconsistent. For example, supposing the knowledge base: $p, p \rightarrow \neg q, r, r \rightarrow \neg p, \neg p \rightarrow q$. From this knowledge base, we can construct an argument to support the claim $\neg q$: $\langle \{p, p \rightarrow \neg q\}, \neg q \rangle$. With respect to this argument, we have an undercutter $\langle \{r, r \rightarrow \neg p\}, \neg p \rangle$ and a rebuttal $\langle \{r, r \rightarrow \neg p, \neg p \rightarrow q\}, q \rangle$.

Given a large and complex knowledge base, arguments will have structural relationships such as subsumption of supports, where one support is a subset of another support, and implication between claims, where one claim entails another. Moreover, there may be more than one argument which undercuts or rebuts another argument. [8,9] define and discuss a range of these relationships among arguments; however, additional definitions are not directly relevant to our key points in this paper. For our purposes, given a knowledge base, we can generate not only the arguments, but also the counterarguments, the counterarguments to these arguments (counter-counterarguments), and so on recursively; such a structure is an *argument tree*, a graph where arguments are

⁵ There is an additional notion of *canonical undercut*, where the atoms are ordered; it is useful for efficiency. For the presentation here, we presume it.

nodes and attack relations are (undifferentiated) arcs. From a given knowledge base, [8] generate all possible arguments and counterarguments.

Our proposal to make a logic-based approach relativised to users is rather straightforward. We use the propositional expression of the logic-based approach to keep the focus to the topic at hand. First, we assume hotel features and evaluative statements with variables are grounded relative to the domain model, yielding saturated propositions. Second, the propositions are the language of knowledge base Δ , which may be inconsistent. Third, the argumentation schemes EL and EQ are arguments in the logic-based approach. The key issue is the representation of the hotel user model. For our purposes, we assume that users are constructed as knowledge bases relative to Δ and indexed to the agent, e.g. $\Delta_{Bill} \subset \Delta$ and $\Delta_{Jill} \subset \Delta$, where $\Delta_{Bill} \cap \Delta_{Jill} \neq \emptyset$, and $\Delta_{Bill} \neq \Delta_{Jill}$. For our purposes, we might assume that each of Δ_{Bill} and Δ_{Jill} are separately consistent. So, the knowledge bases that represent Bill and Jill contain some related information, but differences as well, where the differences represent inconsistent information. We presume that from each of the respective knowledge bases, the EL and EQ argumentation schemes can be formed. Thus, the argumentation schemes for each agent represent that agent’s justification of the conclusion of EL or EQ, yet they have different and mutually inconsistent justifications. This allows us to incorporate a representation of user relativised justification into a formalisation of instantiated argumentation schemes.

4 Related Work and Discussion

Previous work falls into three broad areas: opinion-based approaches, user models, and value expressions. We focus particularly on how the argumentation community has intersected with these areas.

4.1 Opinion-based Approaches

Previous work has addressed evaluative expressions mainly from an opinion-based perspective, without considering argumentative aspects such as arguments and counterarguments. In particular, for [17], the sentiment of a statement (positive or negative) along with its strength and semantic orientation makes it evaluative; no indication of support or attacks (realised or possible) is needed in their view. Rather, they claim that evaluations can be recognized as argumentative based on certain discourse relations, namely that the Justification, Contrast, Concession, relations from Rhetorical Structure Theory (RST) relations [18] are argumentative, while Elaboration is argumentative when it is via either Precision, Comparison, or Contrast [17]. This characterisation of evaluative expressions is incomplete (not least because the particular RST relations are not evident: for instance an earlier analysis by Azar [19] relies on persuasive elements to describe argumentative elements, and contends that five RST relations—Evidence, Justify, Motivation, Antithesis and Concession—are argumentative relations, since they are used to persuade the reader).

RST relations need not serve an argumentative purpose so cannot be taken intrinsically as indicators of argument. Nor, as [17] suggest, is it sufficient to have an evaluative

expression with some RST relation. Where the RST relations function as justification in the face of conflicting information, then they can be part of an argument. RST relations such as *enumeration* are ambiguous and do not intrinsically serve as justification. A recipe can enumerate ingredients without the listed ingredients being premises of a justification. However, when one has a statement that one wants to justify, e.g. that the recipe is suitable for vegetarians, then one might enumerate the ingredients by way justifying this statement. This also requires that there is information about how a recipe would *not* be suitable for vegetarians. The RST relation only has an argumentative function when used for justification. The purpose of the statement is key. Here, enumeration can be used as one *style* of justification, and there are others. In our view, the argumentative force and nature of a statement is derived not from mere sentiment, but rather from the supports and attacks.

The field of opinion mining also offers some approaches to detecting stance and persuasive speech. These could be useful to could help develop and flesh out the user model. ‘Stance detection’ identifies the ‘holistic subjective disposition’ that ‘speaker holds towards a particular political, social or technical topic’, ‘beyond the word or sentence’, for instance to identify rebuttals in online debates [20]. Starting from online debates, [21] has identified expressions (such as ‘insist’) that indicate disagreement, and classified opposing sides in a debate. The purpose is similar to work detecting disagreement with natural language processing [22,23,24,25].

Further, persuasive speech assumes disagreement, since we only seek to convince people who (we believe) hold different positions or points of view. Extracting and detecting persuasive speech could be helpful in identifying the dimensions of user values. Computational detection of persuasion is a new area, which uses machine learning, based on annotated corpora drawn from blogs [26] and police negotiation transcripts [27].

By making the argumentation schemes underlying evaluative expressions more explicit, we move towards clarifying how opinions can be resolved into and understood as argumentation. Evaluative arguments have been generated in previous work, which used multiattribute value functions to tailor arguments to a user’s values and preferences [28]. However, this work did not use argumentation schemes or patterns of argumentation.

4.2 User Models

User modeling began with the study of stereotypes and of speech acts [29], and now has a wide range of applications. Human Computer Interaction researchers have created adaptive systems based on user and task modeling [30]. Personalising e-commerce has received substantial attention [31].

Many natural language generation systems have incorporated user models, which may focus variously on the user’s expertise, interests, or preferences, depending on the purpose or kind of output planned [32]. Human-written messages may also be combined by machine; for instance, [33] uses argumentation and a discourse ontology to select and combine persuasive messages, in order to tailor them to a target audience and user’s current situation. And in recommender systems, case-based reasoning has been used to incorporate critique-based feedback and preference-based feedback [34].

Medical applications are common, and detailed user models have been developed in this domain, in order to support persuasion and transparency [35]. Psychological and affective profiling can be particularly relevant, to model emotional responses to being diagnosed with a genetic disorder [36] or to persuade users to change their diet by modeling user beliefs based on behavioural change models [37].

4.3 Values and Preferences

In abstract argumentation, values and preferences are used in two distinct ways. In one approach, values or preferences are used in the evaluation of argumentation frameworks, in particular, the calculation of the success of attacks [38,39]. This approach is not directly related to our proposal since we do not consider the evaluation of abstract arguments. More closely related are values which appear as terms in instantiations of the Practical Reasoning argumentation scheme [40]. While the values we have discussed are different, we have also used them as terms in an argumentation scheme.

One way to look at the issues raised in this paper is in terms of multiple criteria decision problems, which have been formalised in argumentation frameworks [41,42]. In such approaches, there is meta-level argumentation applied to object level arguments. They address issues bearing on the selection of arguments given various parameters, e.g. whether one wants to offer in a dialogue one argument or another, depending on how aggressive one wants to argue. Thus, they offer a richer means to evaluate arguments. Relevant to our proposal, it is not yet clear precisely where to distinguish the meta from the object level of argument; we have incorporated as at the object level what other proposals might construe as meta level, or vice versa. Furthermore, in this paper, we are more concerned with variant ways to arrive at a decision rather than how to select which argument. Such points must be left for future research.

5 Conclusion and Future Work

The novelty of the paper is in the clarification and development of user-relative arguments to justify evaluative statements. Different users can justify the same evaluation in different ways, allowing for arguments about evaluations to arise. We have tied domain features (in this case about a hotel) to the user's evaluation with respect to an argumentation scheme such that the user justifies the evaluation based on the features. For two different users, although the conclusions are the same in each of the models, how the conclusion is justified can be not just different but incompatible. We have also related the models and instantiated schemes to a formalisation of argumentation where subsets of an inconsistent knowledge base represent each user's knowledge and argumentation schemes are created relative to the user's knowledge base. A user model is represented as the set of grounded propositions for the premises, rules, and presumptive conclusion of the argumentation schemes. As two users can have incompatible knowledge bases, there can be different and incompatible ways to argue for the same conclusion.

Future work in this area could further develop the formal analysis of the users and their reasoning with case-based reasoning or ontologies. Ontologies for specifying domain terminology are essential as users can use different wordings to refer to the same

values or properties being evaluated; ontologies or taxonomies could also be used to specify user models. The key topics are outlined in this static model, but dynamic user models could be developed to update the knowledge base. Alternate approaches to user models could be taken, for instance, to indicate the hierarchy of acceptable values for ranges: for instance if paying 5 euros per 24 hours for Internet access is acceptable, paying any lesser amount would also be available. This work could serve applications in argumentation mining as we have identified specific textual information that ought to be sought to extract arguments. More importantly, to serve an argumentative purpose, some contrasting information must be sought in the textual materials. On this point, our proposal makes an important contribution to the existing literature, and we look forward to extending our analysis to a range of rhetorical relations to specify just how and under what circumstances the relations appear in an argumentative context. We would also seek to integrate our proposal with Practical Reasoning or other argumentation schemes, for instance, arguing for premises with auxiliary schemes. We could also apply techniques from the adaptive or personalisation of web-services in health services. Similarly, our approach could be useful web-based contract negotiation, where automated agents are authorised to negotiate on behalf of human agents [43]. Our user-relative argumentation schemes could also be used in conjunction with AIF, to take user models into account.

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