Basic Human Values and Moral Foundations Theory in ValueNet Ontology

Stefano De Giorgis[1(✉)] , Aldo Gangemi[1,2] , and Rossana Damiano[3]

[1] University of Bologna, Via Zamboni 32, 40126 Bologna, BO, Italy
{stefano.degiorgis2,aldo.gangemi}@unibo.it
[2] ISTC - CNR, Via S. Martino della Battaglia 44, 00185 Roma, RM, Italy
[3] University of Turin, Via Verdi, 8, 10124 Turin, TO, Italy
rossana.damiano@unito.it

Abstract. Values, as intended in ethics, determine the shape and validity of moral and social norms, grounding our everyday individual and community behavior on commonsense knowledge. The attempt to untangle human moral and social value-oriented structure of relations requires investigating both the dimension of subjective human perception of the world, and socio-cultural dynamics and multi-agent social interactions. Formalising latent moral content in human interaction is an appealing perspective that would enable a deeper understanding of both social dynamics and individual cognitive and behavioral dimension. To formalize this broad knowledge area, in the context of ValueNet, a modular ontology representing and operationalising moral and social values, we present two modules aiming at representing two main informal theories in literature: (i) the Basic Human Values theory by Shalom Schwartz and (ii) the Moral Foundations Theory by Graham and Haidt. ValueNet is based on reusable Ontology Design Patterns, is aligned to the DOLCE foundational ontology, and is a component of the Framester factual-linguistic knowledge graph.

Keywords: Moral Values · Knowledge Representation · Frame Semantics · Commonsense Reasoning · Ethics & AI

1 Introduction

Values, as intended in ethics, are part of the "general frame of reference for living" [21], meaning that they are relevant (if not determinant) in our everyday behaviour and decision making, delimiting our conscious self by framing knowledge of what we *should* and what we *desire* [24,27,30,32].

Bilsky and Schwartz investigating the semantics of "values" [3] conceptualize them as similar to social norms, with two important differences: (i) they are not explicitly regulated or formalized, and (ii) their sanction-reward system

operates on the emotional layer [28]. In particular they highlight five recurrent features: 1) they are considered as concepts or beliefs; 2) they are related to some desirable states or behaviours; 3) they can be deduced from their realization in specific situations but they transcend them; 4) they are pivotal for selection or evaluation processes and 5) are often organized by relative importance. The last point in particular is commonly shared among studies on the necessary scalar nature of values [37]. Values are furthermore inextricably related to commonsense knowledge and perspectivization, expression of personal positions and freedom of judgement, although the perspective of values differs from deontic reasoning since, in van Fraassen's words [37], *deontology*, or the theory of obligations "deals with what ought to be because it is required by one's station and its duties, by the web of obligations and commitments the past has spun", while, considering social obligations as kantian schemata, product of the human reason and time and space contextually dependent, *axiology*, or the theory of values, "deals with what ought to be because its being so would be good, or at least better, than its alternative". Finally, values are particularly relevant in dynamics of appraisal [34], since our choices and behaviours are typically affected by our values [3,27]; and by the emotions arising from value-driven appraisal dynamics [26]. In social psychology, in fact, the Contempt-Anger-Disgust (CAD) triad model of moral emotions proposed by [28] relates them to specific configurations of values, termed ethics, inspired by Schweder's work [22] on morality from an anthropological perspective. The CAD triad model relates each emotion type to the violation of a specific ethic: Contempt to the Ethics of community, Anger to the Ethics of autonomy, Disgust to the Ethics of Divinity. These ethics can also be seen as a subset of the value-violation dyadic opposition (e.g. Care vs Harm) constituting the Moral Foundations Theory put forth by Haidt and colleagues [19]. Finally, from a neuro-biological perspective [5], "there was a biological blueprinting for the intelligent construction of human values [...] We also believe that a variety of natural modes of biological responses, which include those known as emotions, already embody such values.". This work moves the first steps towards the formalization of the moral and social values as "abstract objects with social capital" [6] and their structure of relations, investigating the domain of subjective human perception as well as socio-cultural dynamics, focusing in particular on models and theories supported by empirical data - namely the Moral Foundation Theory and Basic Human Values - providing for both an ontological axiomatisation, and showing possible inferences. Formalization is inspired by Constructive Descriptions and Situations (CDnS) [9], assuming values as schemas of social norms that enter the complex dynamics of community acceptance and enforcement.

The paper is organized as follows: in Sect. 2 we provide an overview of the resources reused and already existing material, in particular Sect. 2.1 introduces the frame semantics approach adopted to model the whole ValueNet modular ontology, which is described in Sect. 2.2, in particular ValueCore and MFTriggers modules are described in Sects. 2.3 and 2.4. Section 3 explains the new ontological modules introduced in ValueNet in order to formalize the existing theoretical

background, in particular Sect. 3.1 is focused on Basic Human Values theory, while Sect. 3.2 is focused on Moral Foundations Theory. Finally, Sect. 4 provides some use-case scenarios for the ontological modules introduced, while Sect. 5 envisions further operationalisation and maintenance of the resource.

This work started being developed originally in the SPICE project context, mentioned in the Acknowledgments, and available on GitHub[1].

2 Preliminaries

In this section, we give an overview of ValueNet[2], then we provide an overview of the theoretical background, in particular the Basic Human Values theory [30] and the Moral Foundations Theory [16], formalised with a frame semantics [10] approach (cf. Sect. 2.2).

2.1 Frame Semantics and Framester

The approach adopted to model ValueNet, and to connect it to the linguistic expression of values, reuses the formal representation of FrameNet frames [8] as formalised [25] in Framester [11]. Frames are defined as cognitive representations of prototypical and recurrent features of events or situations. Lexical units semantically related to some scene are associated with frames, based on their schematic structure. In FrameNet, frames are also explained as *situation types*. In Framester semantics [10] observed/recalled/anticipated/imagined situations are consequently occurrences of frames. For example, representing an apparently simple situation like the moral emotion [36] "feeling ashamed" as a framal structure, it would require some *necessary roles* such as an agent feeling the emotion (experiencer), the emotion itself, and eventually some emotion trigger, but also some optional elements such as the intensity, the physiological manifestation, and some external elements such as the duration of the emotion feeling/state.

Framester provides a formal semantics for frames in a curated linked data version of multiple linguistic resources (e.g. besides FrameNet, WordNet [23], VerbNet [29], etc.); a cognitive layer including MetaNet [12] and ImageSchemaNet [7], connecting conceptual metaphors and image schematic sensorimotor patterns to linguistic resources; factual knowledge bases (e.g. DBpedia [2], YAGO [35], etc.), and ontology schemas (e.g. DOLCE [13]), with formal links between them, resulting in a strongly connected RDF/OWL knowledge graph.

2.2 ValueNet

The ValueNet[3] modular ontology is an extension of Framester, therefore values are modeled as framal structures (also in accordance with CDnS) [9], triggered
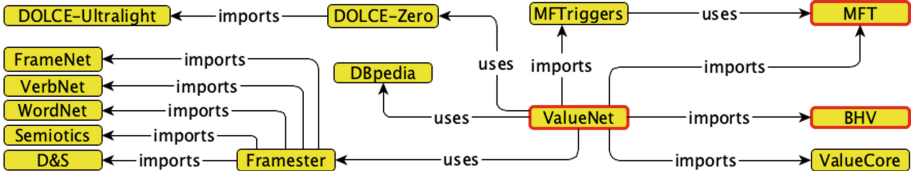

Fig. 1. ValueNet import and usage network.

by other Framester entities, thus enabling a linguistic, cognitive, and factual grounding to values. Its purpose is twofold: (i) it aims at formalizing existing theories about moral and social values, with the goal to create a formal integrated environment, based on the general ValueCore module, described in Sect. 2.3, which allows the integration of theoretical knowledge with experimental data based on a certain theory; (ii) it aims at operationalizing existing theories in order to develop sense-making tools, e.g., a value detector based on MFT, as explained in Sect. 2.4 (Fig. 1).

2.3   ValueCore

The ValueCore module models the notion of "value" as a frame. It reuses the Constructive Description&Situation ontology design pattern [9,14], considering each value of each theory (formalized in separate modules, here we present the Basic Human Values and the Moral Foundations Theory, but Sect. 5 envisions further extensions) as a `fschema:ConceptualFrame`, subclass of `dul:Description`, satisfied by some `vc:ValueSituation`, namely, the realization/occurrence of some prototypical type of event involving some value. Being a core module, it generalises specific notions of value, in order to cover every possible value situation. According to the current literature, the ValueCore module includes three main types of value-driven situations: (i) `vc:ValueAppraisal`: the appraisal of a situation performed by an agent, pivoted by a value; (ii) `vc:ValueCommitment`: the commitment of an agent to a value; and (iii) `vc:ValueRecognition`: the recognition, namely, the plain existence assertion, operated by some agent, of a value in some context. These three types of situation, modeled as framal structures including necessary, optional and external roles, allow to model any type of event including some value, with an increasing detail, proportional to the granularity of the scenario taken in consideration.

The ValueCore module can be explored online[4] or via the Framester endpoint[5].

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[4] The ValueCore module is available here:
https://raw.githubusercontent.com/StenDoipanni/ValueNet/main/ValueCore.ttl.

[5] The Framester endpoint is available here: http://etna.istc.cnr.it/framester2/sparql.

2.4   MFTriggers

Another module included in ValueNet is MFTriggers. MFTriggers intends to fill a gap: there is no repository that provides alignments of entities from different semantic layers (lexical units, semantic roles, framal structures, factual entities, etc.), to a social or moral value from any theory. Albeit the Extended Moral Foundations Dictionary [20] has been used to train neural models with the task of detecting moral values, no direct lexical grounding has been provided for any of the elements of the Graham and Haidt's dyadic oppositions, let alone as knowledge graphs.

Therefore, we use MFTriggers to support value detection and value extraction from natural language. MFTriggers introduces a lexical and factual grounding for the Moral Foundations Theory, and therefore for MFT ontological module[6]. Future further operationalisations for other modules and theories (e.g. BHV) are envisioned in Sect. 5.

The automatic values extraction from natural language includes the usage of the FRED tool, a hybrid statistical and rule-based knowledge extraction system to generate RDF and OWL knowledge graphs taking as input directly text from natural language.

The value extraction workflow is composed by three main steps: (i) the first step is to take a sentence and pass it to FRED tool. Figure 2 shows the graph automatically generated for the sentence "*We are organizing a protest against dictatorship.*"[7].
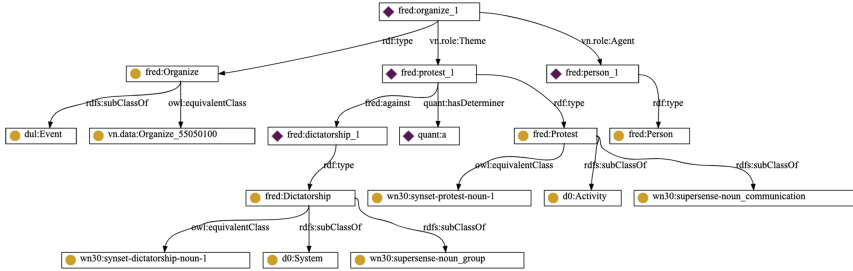

Fig. 2. FRED graph automatically generated for the sentence *We are organizing a protest against dictatorship.*

The second step (ii) consists in taking all the subjects, predicates, and objects of all triples, namely all nodes and arches in the graph, to query the ValueNet graph, in particular, at the current state, the MFTriggers graph, via SPARQL

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[6] MFTriggers building process is available here: https://github.com/StenDoipanni/ValueNet/tree/main/MFTriggers.

[7] FRED online demo is available at: http://wit.istc.cnr.it/stlab-tools/fred/demo/.

queries, to check if there is any semantic trigger (any entity from FrameNet, WordNet, VerbNet, DBpedia etc.) triggering of some value[8].

Finally, (iii) for each triggering occurrence retrieved, a triple is added to the original graph declaring the activation. In the example above: the WordNet synset `wn:synset-protest-noun-1` triggers `mft:Subversion` and the synset `wn:synset-dictatorship-noun-1` triggers `mft:Oppression`.

3   ValueNet Theoretical Modules

The following sections introduce the BHV and MFT ontological modules, namely the transposition of the Basic Human Values theory and the Moral Foundations Theory in ontological form, showing their main focus and possible inferences. BHV and MFT as theories share some overlaps but start from quite different perspectives, greatly simplified: both theories propose a "universal" model, namely a model which should provide a cultural-agnostic explanation for the whole human value system, and for this reason are modeled in ValueNet. But while MFT adopts a more developmental perspective (explained in detail in Sect. 3.2), BHV considers many socio-behavioral factors. This difference results in both theories having a relational "opposition" of values but while MFT is organized in dyadic oppositions of one value and its violation, BHV circumplex model does not contemplate direct violations, but rather opposition of behavioral focus and attitude.

3.1   Basic Human Values

The Theory of Basic Human Values (BHV) by Shalom Schwartz was proposed as a pan-cultural theory in the 1980s. Its main assumption is that human values are organized in a "value wheel", that is, an ordering structure that organizes values as a circumplex model, dividing them in four quadrants with two opposing axes, and a congruity continuum between adjacent values.

Originally, the model included 10 values [30], but, as shown in Fig. 3, the model was later refined to 19 values in total [32]. BHV relies on the opposition and similarity of values, grouped into macro-categories that are mostly determined by individual personality traits (self-transcendence vs self-enhancement, conservation vs openness to change). This model has inspired the design of a questionnaire (Portrait Values Questionnaire, PTV) which has been employed by a number of studies to explore values across different countries [33]. In recent work [31], Schwartz provides evidence in favour of a pan-cultural arrangement of value priorities.

BHV has been tested on a vast number of subjects across 82 countries. However, one of the main criticism is its top-down approach, establishing the number and taxonomy of values a-priori, and then validating it through dedicated experimentation.

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[8] Some useful explorative queries are available at: https://github.com/StenDoipanni/ValueNet.
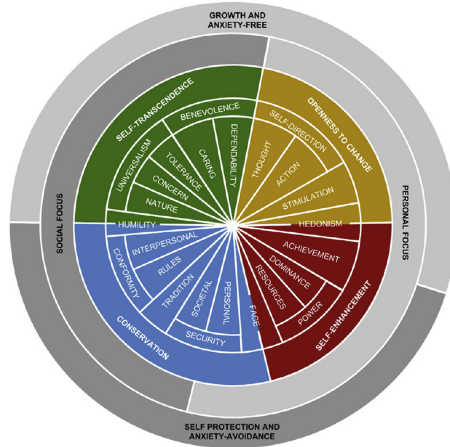
Fig. 3. Basic Human Values circumplex model, image taken from [Giménez, August Corrons, and Lluís Garay Tamajón. "Analysis of the third-order structuring of Shalom Schwartz's theory of basic human values." Heliyon 5.6 (2019): e01797.]

BHV Classes. The ontology takes as source the BHV model reworked as in [15]. It is the attempt to formalize values as an *inner behavioral nudge*, related to outer stimula, towards one (or more) of the four main axes as explained in the following.

The ontology includes 2 top classes representing the "attitude", i.e., a general view of the world, driving some more specific ordering principles; 2 classes representing a "focus", i.e., a taxonomical criterion that addresses the entities (social group, individual, society, class) supposed to profit the most from some value; 4 third order clusters of values, which split the circumplex model in four quadrants, creating diagonal opposition and topical continuity; 12 second order values, namely more specific clusters of values considering a more fine-grained granularity in framing events and situations of the world; and finally 19 first order values, which explicitly state the patient/beneficiary of some value. We list here the ontological classes and axioms, from the most general ones (which in the circumplex model corresponds to most external sectors), to the most specific.

The highest order layer of the circumplex model is formalized as follows:

- `bhv:GrowthAndAnxietyFree`: This is a pro-active attitude, characterizing a self-trascendent view of the world and a higher openness to novelty and change.
- `bhv:SelfProtectionAndAnxietyAvoidance`: this is a more reactive attitude, characterizes as a self-centered view of the world fostering a closer and conservative attitude.

Note that, as shown in Fig. 3, the outer "attitude" ring and the "focus" one have no direct relation between them, being offset from each other, while the main

four quadrants, and, as consequence, the single values, are instead axiomatised with restrictions on their attitude and focus. Moving therefore one ring inward into the circumplex model, the "focus" concept is specified in two classes and modeled as follows:

– `bhv:SocialFocus`: Focus on social issues and others than self, or focus on self, considered as a member of a social community. The focus expresses the main beneficiary of the behaviour determined by some Value e.g. the class `bhv:SelfTrascendence` is the superclass grouping all the Values having as focus society more than the individual;
– `bhv:PersonalFocus`: Focus on personal issues and self, both as realization of self intended as freedom of thinking and action as well as dominance over others.

The third order values layer structures the four main quadrants of the circumplex model. These are modeled as superclasses of more specific value situations, following Constructive Description and Situation pattern, considering more specific classes of situations as subclasses of more general ones, satisfying more specific descriptions, subclasses in turn of more general ones. Considering diagonal oppositions (meaning having an opposed value motivation), and according to their focus and attitude they are:

– `bhv:Conservation`: This macro category is focused on "preserving stability and security", in particular "with the emphasis on subservient self-repression, the preservation of traditional practices and protecting stability". In the BHV ontological module `bhv:Conservation` class of value situations is axiomatised as:

$$
\begin{aligned}
&\text{SubClassOf:}\\
&((\texttt{attitude some SelfProtectionAndAnxietyAvoidance}) \text{ and}\\
&(\texttt{attitude only SelfProtectionAndAnxietyAvoidance})) \text{ and}\\
&((\texttt{focus some PersonalFocus}) \text{ or } (\texttt{focus some SocialFocus}))
\end{aligned}
\tag{1}
$$

Its opposite quadrant is:

– `bhv:OpennessToChange`: it consists in readiness for new experience, self centered values which foster physical and intellectual freedom and fulfillment. `bhv:OpennessToChange` class of value situations is axiomatised as:

$$
\begin{aligned}
&\text{SubClassOf:}\\
&((\texttt{attitude some GrowthAndAnxietyFree}) \text{ and}\\
&(\texttt{attitude only GrowthAndAnxietyFree})) \text{ and}\\
&((\texttt{focus some PersonalFocus}) \text{ and}\\
&(\texttt{focus only PersonalFocus}))
\end{aligned}
\tag{2}
$$

The sibling class to
`OpennessToChange` in the circumplex model is:

– `bhv:SelfEnhancement`: it consists in promoting self-interest, often at the expense of others, emphasising the search for personal success and dominance over others. `bhv:SelfEnhancement` class of value situations is axiomatised as:

$$
\begin{aligned}
&\texttt{SubClassOf:}\\
&((\texttt{attitude some GrowthAndAnxietyFree}) \text{ or}\\
&(\texttt{attitude some SelfProtectionAndAnxietyAvoidance})) \text{ and}\\
&(\texttt{focus some PersonalFocus}) \text{ and } (\texttt{focus only PersonalFocus})
\end{aligned}
\tag{3}
$$

In the opposed quadrant to `bhv:SelfEnhancement` there is:

– `bhv:SelfTrascendence`: it consists in promoting the well-being of society and nature above one's own interests, highlighting the acceptance of others as equals, as well as a concern for their well-being. `bhv:SelfTrascendence` class of value situations is axiomatised as:

$$
\begin{aligned}
&\texttt{SubClassOf:}\\
&((\texttt{attitude some GrowthAndAnxietyFree}) \text{ and}\\
&(\texttt{attitude only GrowthAndAnxietyFree})) \text{ and}\\
&((\texttt{focus some SocialFocus}) \text{ and } (\texttt{focus only SocialFocus}))
\end{aligned}
\tag{4}
$$

Finally, the full list of 19 first order BHV values is shown in Fig. 3 and each value class is described in the OWL file[9].

BHV Object Properties. The object properties modeled in BHV module are:

– `bhv:attitude`: this property is used to declare the attitude corresponding to some values, namely `bhv:SelfProtectionAndAnxietyAvoidance` (re-active attitude) vs `bhv:GrothAndAnxietyFree` (pro-active attitude).
– `bhv:focus`: this property is used to declare the focus corresponding to some values, namely `bhv:SocialFocus` vs `bhv:PersonalFocus`.
– `bhv:opposingFocus`: serves the function of modelling oppositions, as described in previous paragraphs and shown in Fig. 3.
– `bhv:opposingValueMotivation`: Following the polarity opposition Conservation vs OpennesToChange and SelfTrascendence vs SelfEnhancement, this property is used to axiomatise all the 4 third order classes of values declaring them as `EquivalentTo: opposingValueMotivation some` and `opposingValueMotivation only` the value in the opposite diagonal quadrant.
– `bhv:panCulturallyMoreImportantThat`: to express the eventuality of building a Pan Cultural Baseline For Values Priority.

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[9] The ontology is available here: https://github.com/spice-h2020/SON/blob/main/SchwartzValues/ontology.owl.

BHV Competency Questions. BHV module allows to answer some CQs according to BHV theory, such as:

1. Is the entity x an instance of some value, according to BHV theory?
2. What values have as focus some `bhv:SocialFocus` or `bhv:PersonalFocus`?
3. What is the `bhv:opposingFocus` of some value?
4. What is the attitude of some value?
5. What is the opposing value motivation for some value?

3.2   Moral Foundations Theory

The Moral Foundation Theory (MFT) is proposed as a cultural-independent theory of moral and social values, inspired by Schweder's et al. work on universal human ethics [22] and tightly related to the investigation of moral emotions, with a particular focus on behavioural neuro-cognitivism. Its agnostic point of view towards cultural dependencies is realized via its dyadic oppositional structure. On one hand, the intension of value-violation dyadic oppositions is supposed to be cultural independent; on the other hand, their extension is dependent on the actual realization of one (or more) dyadic value in some situation of the real world. The model proposed by [17] focuses mainly on single value oppositions, where any pair of opposing values represents the poles of a prescribing/inhibiting dyad. MFT describes six innate moral foundations across cultures and societies:

- Care vs Harm is grounded in the attachment systems and some form of empathy, intended as the ability to not only understand, but also feel, the same feelings as others, thus being able to imagine hypothetical scenarios, in which we are living some positive or negative mental or physical state, which we actually don't live.
- Fairness vs Cheating is grounded in the evolutionary process of reciprocal altruism.
- Loyalty vs Betrayal is grounded in the clans and family-based dimension that for a long time characterized most of our tribal societies. The ability to create links and alliances was a way to increase the surviving percentage possibilities for oneself and his/her close group.
- Authority vs Subversion is grounded in the hierarchical social interactions directly inherited by primates' societies.
- Sanctity vs Degradation is grounded in the CAD triad emotions (Contempt, Anger, Disgust) and the psychology of disgust, it is one of the most spread dyadic oppositions, underlying religious (and not only) notions of living in an elevated, less carnal, more ascetic way. It underlies the idea of "the body as a temple" which can be contaminated by immoral activities and it is foundational for the opposition between soul and flesh.
- Liberty vs Oppression is grounded in feelings and experiences like solidarity, vs. episodes of unjustified violence or liberty restrictions.

Besides its relevance for the investigation of the emotional counterpart of value appraisal and for the cross-cultural investigation of values, MFT has

inspired the design of the Moral Foundation Dictionary [18] and, more recently, of the Extended Moral Foundations Dictionary [20], which combine theory-driven elements on moral intuitions with a data-oriented approach. Relationship with the emotion knowledge layer is envisioned as future work in Sect. 5.

Factual situations can evoke some Value, and be opposed by some Violation, creating multi-shaped scenarios, in which the same Event or Action or Entity can evoke different Values and their Violations at the same time.

MFT Classes. The MFT module is light-weighted considering the number of axioms, due to the fact that the whole theory is based on direct dyadic opposition of values and violations. MFT classes are:

– `mft:DyadicOpposition`: this is the superclass for all the value-violation dyads. It `dul:hasComponent` exactly 1 value and exactly 1 violation.
– `mft:Value`: this is the class for "positive" values shaping some behavior, it is subclass of `vc:Value` in the ValueCore module.
– `mft:Violation`: this class represent the violation to some value, they can also be conceived as "negative" values.

MFT Object Properties. The object properties modeled in MFT module are:

– `mft:opposedTo`: some value is opposed to its violation in the dyadic structure. This property is symmetric.
– `mft:violates`: some violation violates some `dul:Norm`.
– `dul:hasComponent`: this property expresses the mereological aspect of some dyad.

MFT Competency Questions. MFT module and (MFTriggers) allow to answer some CQs according to MFT theory, such as:

1. Is the entity x an instance of some value, according to MFT theory?
2. What is the value `mft:opposedTo` some entity x?
3. Is there some value in the sentence y?
4. What is the value profile of (namely the set of values activated by) some word or sentence?

4   Evaluation: BHV and MFT Use Cases

BHV and MFT describe primitive framing of values as descriptions, and are typically associable to real world occurrences (situations), named `vc:ValueSituation`. A value situation presents elements coherent to the conceptualization of BHV or MFT, so that it can answer competency questions mentioned in Sects. 3.1 and 3.2.

To allow an evaluation of the ontological module we propose here a scenario answering CQs mentioned in Sect. 3.1 and 3.2, involving at the same time three types of value situations according to ValueCore module, namely

`vc:ValueRecognition`, `vc:ValueAppraisal` and `vc:ValueCommitment`. Furthermore, the methodology mentioned in Sect. 2.4 is extensively tested in [1] where a graph-based Value Detector is compared to (and equals the performance of) state of the art Zero-shot learning method for a Value Detection task.

Value Scenario. UserA and UserB are visiting an art gallery and see a painting depicting Pietro Micca ("Pietro Micca nel punto di dare fuoco alla mina volge a Dio e alla Patria I suoi ultimi pensieri" - "Pietro Micca, the moment before setting fire to the bomb, directs his thoughts to God and his motherland") by Andrea Gastaldi. Pietro Micca is described as an Italian patriot who gave his life to save the to-be-born state of Italy, igniting some dynamite to detonate a tunnel that was being invaded by enemy soldiers.

Pietro Micca's action can be modeled as a `vc:ValueCommitment` situation, nested in two different interpretations of UserA and UserB which can be modeled as `vc:ValueRecognition` situations, and for each of them would be possible to express the appraisal and the desirability of some action for both Users in a `vc:ValueAppraisal` situation[10].

4.1   BHV Inferences

UserA declares to be proud of the action made by Pietro Micca, sharing with him the value "Patriotism". UserB disagrees considering more important "Self Preservation" than sacrificing one's own life to defend the country. Thanks to BHV module and the lexical tokens linked to the first order values, "Patriotism" is inferred as being an instance of both `bhv:Societal` and `bhv:Caring` (see Sect. 3.1 CQ1), subclass of `bhv:Security` and `bhv:Benevolence` and therefore having as opposing value motivations (namely being in the quadrant opposed to) both `bhv:SelfEnhancement` and `bhv:OpennessToChange` (see Sect. 3.1 CQ5), while "Self-Preservation" is an instance of `bhv:Action`, subclass of `bhv:SelfDirection`.
We can infer that UserA's instance of "Patriotism" has `bhv:focus` some `bhv:SocialFocus` (see Sect. 3.1 CQ2) and attitude both `bhv:SelfProtectionAndAnxietyAvoidance` and `bhv:GrowthAndAnxietyFree` (see Sect. 3.1 CQ4); while for UserB's value instance we can infer that it has some `bhv:PersonalFocus`, opposed to UserA's focus (see Sect. 3.1 CQ3) and `bhv:GrowthAndAnxietyFree` attitude.

Similar scenarios to the one proposed here in natural language are available serialized in turtle syntax both on the ValueNet and SPICE project GitHub. Finally, a knowledge graph of semantic triggers operationalizing BHV theory in

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[10] We do not provide details about the ValueCore possible inferences here since it's not the main focus, but further details are available on the ValueNet GitHub:
https://github.com/StenDoipanni/ValueNet
and on the SPICE project GitHub:
https://github.com/spice-h2020/SON/blob/main/SchwartzValues/Schwartz_scenario.ttl.

order to provide an automatic extraction of value situations and value detection from natural language (as for MFT, in MFTriggers graph described in Sect. 4.2) is being developed and is mentioned as future work in Sect. 5.

4.2 MFT Inferences

UserA declares to be proud of the Action made by Pietro Micca, focusing on the result of this action, namely the Liberty of Italy. UserB disagrees, considering more important Pietro Micca's life than any victory in war, in fact she/he considers it useless to sacrifice oneself for any country. Thanks to MFTriggers "LibertyOfItaly" is inferred as triggering a `mft:Liberty` value Situation and "PietroMiccaSacrifice" is inferred as triggering an `mft:Harm` situation (see Sect. 3.2 CQ3-CQ4). Thanks to the MFT dyadic model, "LibertyOfItaly" is inferred as being an instance of `mft:Liberty` (see Sect. 3.1 CQ1), while "CareOfPietroMicca" is an instance of `mft:Care`, being opposed to "PietroMiccaSacrifice", which is an instance of `mft:Harm` (see Sect. 3.1 CQ2).

5   Conclusions and Future Improvement

We presented here the BHV and MFT theoretical modules integrated in the ValueNet ontology. The ontology is an ongoing attempt to formalize different perspectivizations depending on the cognitive framing that agents make in relation to some stimulus. The current version includes the ValueCore and MFTriggers modules, as well as the newly introduced and presented here BHV and MFT ontologies.

Future developments on the theoretical side include the introduction of new theoretical modules, such as Curry's "Moral Molecules" [4] theory[11]; while on the operational side they include the semantic triggers knowledge graphs generation, starting from resources like Schwartz's Portrait Value Questionnaire [31]. Furthermore, another interesting direction of research would be to conjugate this symbolic approach with BERT-like pre-trained models. On a parallel research direction ontological modules formalizing theoretical Emotion theories and generating semantic triggers knowledge graphs are being developed and introduced as an Emotion knowledge layer in the Framester resource. Future developments will be to conjugate these two intertwined layers in more complex formal semantics representations.

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[11] Curry's ontological module is available at:
https://github.com/StenDoipanni/ValueNet/tree/main/MoralMolecules.

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