Ontological modeling of observations: Case studies in the Humanities

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Based on ongoing research work (to be presented at **FOIS 2023**) with Roberta Ferrario, Claudio Masolo, Daniele Porello, Antonio Sotgiu, and Gaia Tomazzoli

1   Research goal

To provide a modeling framework

- To *partially* **document** observations in such a way
  - To compare them to assess their commonalities and departing points [**focus here**]
  - To possibly individuate argumentative strategies
  - To exploit formal and computational mechanisms for their analysis (possibly in tandem with ML and NLP techniques)

2   Intuitions /1

At first glance, we can think of observations as

- Having a **contextual nature**: provenance (who, when)
- ... and a **public dimension**: inter-subjectivity
- Being expressed on the basis of **observational methods** and **means**: e.g., musical analysis, measurement tools
- .. through a specific **vocabulary** (possibly shared)
- Having different "argumentative roles". Some of them are sorts of **premises** to support **conclusions**

3   Intuitions /2

From a general perspective, we need to understand (at least)

- How to **conceptualize** observations within a larger ontological framework
- How to build a model to express observations trading-off **generality** (for reusability) and **specificity** (for domain studies)

4   Some challenges

- Which vocabulary and formal constraints?
  - Example: **IF** A and B are observed as sharing a common musical pattern, **THEN** we can conclude that A and B are similar
  - Is this classical material implication?
- What to do when scholars – within the same community – use multiple vocabularies or use different argumentative approaches?
- What to do when scholars – within the same community and analyzing the same phenomenon – express incompatible claims?

5   Observations /1

On the basis of previous work, **observations**:[1]

- *Classification* of domain entities via multiple modalities, e.g., analytic, cognitive, technical procedures
- Abstract from single observers and observing acts: multiple agents can express the same observation
- Are *truth-bearers*
- Are *not* necessarily truthful, i.e., they may *not* match how the world is

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[1]Masolo, C., Botti Benevides, A., & Porello, D. (2018). The interplay between models and observations. Applied Ontology, 13(1), 41-71.

6   Observations /2

Introduction of an **observational language** (L):

- Finite set of *observation kinds*
- ... that are taxonomically organized
- Each kind collects the classification of an entity under the same property (relation)
- Each kind in L involves *ith*-entities
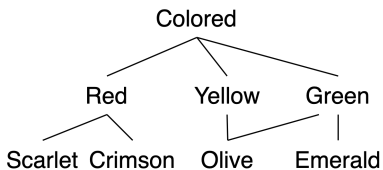
7   Example / 1

Figure 1: Example of taxonomically organized observation kinds for colors (from **Masolo et al. 2018**)
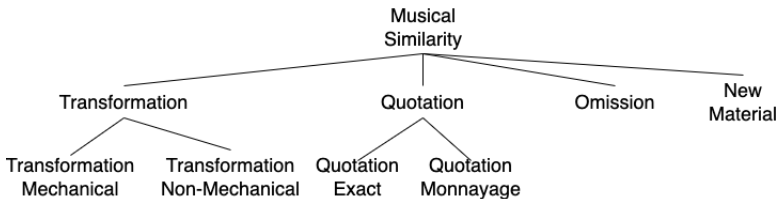
Example /2

Figure 2: Example of taxonomically organized observation kinds for musical relationships of similarity (based on **CRIM project**)

9   Example /1-2 (continued)

Formally, first-order logic (FOL) modeling framework

f1 $Red(o) \wedge ARG_1(o, tsht_{es})$

<div align="right">(my t-shirt is observed as being red)</div>

f2 $Quotation(o) \wedge ARG_1(o, pbe) \wedge ARG_2(o, pg)$

(a pattern of Josquin Des Prés' *Benedicta es* stands in a similarity of quotation with a pattern of Giovanni Pierluigi da Palestrina's *Gloria*)

$\rightarrow$ the **basic** picture

Recent research work:

- **Assertion/rejection**: the *source* of an observation; $ass(s, o)$, $rej(s, o)$, e.g., $ass(tlx, quotation(pbe, pg))$
- **Support**: an observation is a *hint* for another observation; $sup(o, o')$, e.g., $sup(quotation(pbe, pg), modelFor(pbe, pg))$
- **Defeat**: an observation *defeats* another observation; $def(o, o')$, e.g., $def(red(tsht_{es}), green(tsht_{es}))$

$\rightarrow$ These are more complex observations!

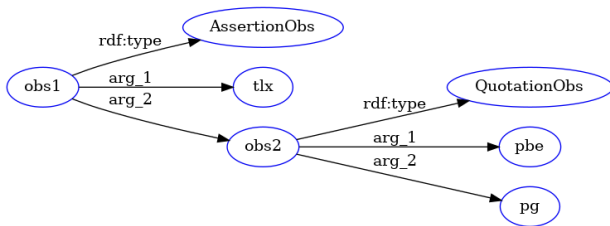Observations as RDF graphs

Figure 3: Example of observation of musical similarity as RDF graph (according to obs_1 tlx is the source of obs)

Remarks

12 Formal characterization / 1

For instance,

- If $sup(o_1, o_2)$ and $sup(o_2, o_3)$, then $sup(o_1, o_3)$ (transitivity?)
- If $ass(s, o_1)$ and $sup(o_1, o_2)$, then $ass(s, o_2)$? (ass-sup chain?)

Tricky, because scholars adopt different kinds of argumentative strategies. For instance:

- $ass(bum, sup(sim(gua, cup), rewr(tlx, cps)))$
- $ass(bum, sup(rewr(tlx, cps), hum(boc)))$
- $ass(bum, sup(sim(gua, cup), hum(boc)))$ – **NO!**

$\rightarrow$ A case against transitivity of sup

13   Formal characterization /2

Because what just said, no axiomatic characterization of observation kinds like ass/rej/sup/def and their interrelations

The intuition is that based on

- The **application scenarios** at hand,
- Studies in **argumentation theory** and **justification logics**, among others
  - We introduce formal definitions as sorts of modeling macros to analyze observations or sources against certain patterns (next slides)

Examples of definitions as modeling macros:

- $\texttt{sINC}(c) \equiv \exists o o_1 o_2 (o_1 = \textbf{ass}(\text{kb}, \textbf{ass}(c, o)) \wedge o_2 = \textbf{ass}(\text{kb}, \textbf{rej}(c, o)))$
  (**strong incoherence of texts**: a "text" is strongly incoherent when according to certain observations, it asserts and rejects something)

- $\texttt{DIS}(o) \equiv \exists c_1 c_2 o_1 o_2 (o_1 = \textbf{ass}(\text{kb}, \textbf{ass}(c_1, o)) \wedge o_2 = \textbf{ass}(\text{kb}, \textbf{rej}(c_2, o)))$
  (**disputability of observations**: an observation is disputable when it is asserted and rejected)

15 Case study

16   Literary observations

Decameron, Tale X, 10 ("Griselda"), and its interpretations

- **Branca:** compares Boccaccio with the Medieval culture; connection between D. and hagiographic narratives; similarity between Griselda and Virgin Mary.
  Supporting arguments: linguistic and stylistic features

- **Picone:** compare B. with chivalric and courtly literature – Marie de France's *Lais*; similarity between Griselda and Fresne, etc.
  Supporting arguments: narrative similarities.

- **Candido:** compare B. with the classic culture – Apuleius' *Metamorphoses*; B. as a humanistic author; similarity between Griselda and Psyche, etc.
  Supporting arguments: linguistic features, narrative similarities, Boccaccio's knowledge of Apuleius' works, etc.

17 Examples of lit.obs. / 1

Examples of **characters' interpretations**:

- $\mathbf{ass}(\mathrm{bum}, \mathbf{sim}(\mathrm{gua}, \mathrm{cup}))$; $\mathbf{ass}(\mathrm{bum}, \mathbf{sim}(\mathrm{gri}, \mathrm{psy}))$ [**Candido**]
- $\mathbf{ass}(\mathrm{bmd}, \mathbf{sim}(\mathrm{gri}, \mathrm{mar}))$ [**Branca**]
- $\mathbf{ass}(\mathrm{bcn}, \mathbf{sim}(\mathrm{gua}, \mathrm{gud}))$; $\mathbf{ass}(\mathrm{bcn}, \mathbf{sim}(\mathrm{gri}, \mathrm{fre}))$ [**Picone**]

These similarities are stated in terms of **shared properties**, e.g.,

- $\mathbf{ass}(\mathrm{bum}, \mathbf{sup}(\mathbf{ass}(\mathrm{f}'_{\mathrm{tlx}}, \mathbf{hstat}(\mathrm{gua})) +$
$\mathbf{ass}(\mathrm{f}'_{\mathrm{cps}}, \mathbf{hstat}(\mathrm{cup})), \mathbf{sim}(\mathrm{gua}, \mathrm{cup})))$

18 Examples of lit.obs. / 2

Also, from these two observations

- $\mathbf{ass}(\mathrm{bmd}, \mathbf{sim}(\mathrm{gri}, \mathrm{mar}))$ [**Branca**]
- $\mathbf{rej}(\mathrm{bcn}, \mathbf{sim}(\mathrm{gri}, \mathrm{mar}))$; [**Picone**]

  $\rightarrow$ the observations $\mathbf{sim}(\mathrm{gri}, \mathrm{mar})$ is **disputable** in the sense of

- $\mathrm{DIS}(o) \equiv \exists c_1 c_2 o_1 o_2 (o_1 = \mathbf{ass}(\mathrm{kb}, \mathbf{ass}(c_1, o)) \wedge o_2 = \mathbf{ass}(\mathrm{kb}, \mathbf{rej}(c_2, o)))$

19   Conclusions

The approach

- At the general level, it relies on studies at the intersection between formal ontology, argumentation theories, and justification logics

- Literary studies (as domain application, work in progress)

  The research aim is two-sided:

  1. Conceptual, formal framework for the (partial) modeling of observations for

  2. Digital scholarly criticism

20 Thank you

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