5.4 Towards Operationalizing Frames through Axiomatization

Liesbeth Allein (KU Leuven, BE)
Philipp Cimiano (Universität Bielefeld, DE)
Ivan Habernal (TU Darmstadt, DE)
Martin Potthast (Leipzig University, DE)
Arno Simons (DZWH – Berlin, DE)
Benno Stein (Bauhaus-Universität Weimar, DE)

This section summarizes the results of a working group discussion during the Dagstuhl Seminar 22131 "Framing in Communication: from Theories to Computation." Given the large number of diverging and competing frameworks and theories used to analyze framing in the computer science, the social sciences, and the digital humanities, this working group started from first principles by attempting to capture frames through axiomatization.

5.4.1 Axiomatization of Frames

An axiom declares a salient property of a real-world phenomenon. A set of axioms, or axiomatic systems, inductively defines the phenomenon if it entails all basic properties of the phenomenon that are not implied by others known about it. Such a set of axioms is irreducible. It opens the door to theoretical analysis of the phenomenon, i.e., the derivation of theorems that govern it. If derived theorems can be verified by observation in the real world, this raises trust in the validity of the set of axioms. A set of axioms only serves as a theoretical model of a phenomenon, if its derivable theorems predict real-world observations with sufficient accuracy.

Axiomatization relieves us from having to define frames directly, as definitions of seemingly elusive concepts, and those of frames in particular, are notoriously subject to fierce debate. In contrast, basic observations of and about frames are much less subject to debate.

As a first step towards an axiomatization of frames, we state the following three axioms:

- **Axiom 1.** Frames exist.

- **Axiom 2.** Exposure to frames has measurable effects.

- **Axiom 3.** A frame can be defined by what belongs to the frame, or by what does not belong to the frame. We call the latter a co-frame ("frame dualism").

These axioms capture fundamental prerequisites for an operationalization of frames.

Axiom 1 postulates the existence of frames in communication. Frames have a representation both in people's minds as well as in communication media, language in particular. When a frame is adopted by people, they can do this more or less reflexively (i.e., knowing that they adopt a particular frame rather than another frame). Axiom 2 postulates that frames can have measurable effects in the real world. For instance, people may change their behavior as a result of adopting a frame. Or the presence of a frame in a given piece of writing may be noticed by them. Axiom 3 postulates that the definition of a given frame can be discerned by investigating its "boundary", i.e., a frame can be discriminated from its surroundings. For example, words can be identified that have a clear connotation with the frame, or actions of people, or depictions of situations, etc. This renders frames also distinguishable from other frames, albeit interrelations between frames are not excluded. Everything that does not belong to a given frame is collectively referred to as its co-frame,

thus inducing a kind of frame dualism. When dealing with an inventory of frames (i.e., string names of frames), given one frame X, all other frames from the inventory combined are its co-frame. A co-frame can also be described by a ranking of frames according to saliences of the frame in question. The most salient frame Y of the co-frame $\bar{X}$ of frame X is its main co-frame. We do not claim this set of axioms to be complete, i.e., there may be more axioms required to derive all properties of frames that have been previously observed.

From Axioms 1 and 2, it follows that the knowing or unknowing adoption of frames, and their possible measurable effects on people's behavior induces what we call camps: We define a camp by those people who share a common understanding of / recognition of / reaction to exposure to frame X.

As a further consequence of Axiom 2, the measurability of a frame also opens the door to its quantification. In this regard, we hypothesized that the presence of a frame may vary in terms of how well it can be recognized, called "strength" in our discussions at the time. In hindsight, a better choice of terms would have been "perceptibility", since this term comes with less ambiguous connotations.

5.4.2 Small Empirical Study

We conducted a brief framing perceptibility user study to support Axiom 2. We extracted six tweets about the ongoing Russian invasion of Ukraine that are said to evoke the genocide frame. Given a pair of tweets, the 21 participants of the seminar present at the time were then asked to indicate ad hoc and independent of each other in which of the two the frame of genocide is more perceptible. In our words then, which tweet contains a stronger genocide frame. We asked for participants' opinions about three pairs:

- Tweet A1 (weaker). Ex. 2:
  ```
  A genocide that didn't happen; nuclear ambitions that Ukraine doesn't have and a
  threat to Russia that does not exist.  I have yet hear a single justification for
  the murderous invasion of this country that even remotely bears scrutiny.
  #Ukraine
  ```

- Tweet B1 (stronger). Ex. 8:
  ```
  How are Western leaders sleeping during this genocide?  It was posted by a woman
  who recorded herself right after the attack #Ukraine
  ```

- Tweet A2 (weaker). Ex. Y:
  ```
  Putin claims he is attacking to eliminate #Ukraine's "Nazi" government...  headed
  by a Jewish president!  Screw sanctions, Putin only cares about the price of oil.
  If Biden would end the insane embargo of Venezuela, oil prices would collapse and
  so would Putin's killing spree.
  ```

- Tweet B2 (stronger). Ex. X:
  ```
  #Putin is committing mass murder in #Ukraine.  Why are we not doing everything in
  our power to stop him?
  ```

- Tweet A3 (stronger). Ex. Z:
  ```
  US taxpayer $$$ will fund mass murder and ethnic cleansing in my country,
  Ukraine.
  ```

- Tweet B3 (weaker). Ex. 3:
  ```
  Outrageous hypocrisy!  This is the military who have committed human rights
  atrocities & genocide for decades in the name of "Burma's sovereignty".  Both
  regimes must be held accountable for all serious human rights violations.
  #Ukraine
  ```

Our basic operationalization of frame perceptibility (strength) to arrive at ground truth labels was this: We define the strength of a frame as the number of references to the frame. Applied to the tweets, this meant we counted the number of term occurrences which either directly refer to genocide, or have a connotation with the frame (highlighted bold), in context of what the tweet was intending to say. Tweet B3 referred to another genocide, not the one in Ukraine. The voting was as follows:

```
A1:  6 vs. B1: 15
A2:  6 vs. B2: 14 vs. Tie: 1
A3: 14 vs. B3:  6 vs. Tie: 1
```

This distribution of votes results in a Krippendorff's Alpha of -0.0349, which indicates random inter-annotator agreement and negative results for our ad hoc experiment, despite the seeming tendency of the group towards the true answer. So, while the majority decision would have been correct in all three cases, no individual annotator performed consistently well. Two comments were given by annotators: "Framing does not have ‹strength›" and "‹Stronger›is the wrong conceptualization", prompting a discussion and our change of terminology suggested above.

Axioms 2 and 3 imply that frames are discernible entities, an important prerequisite for any kind of operationalization of frames or framing. A frame provides a structure for perceiving and interpreting phenomena in a particular way. Elements of such structures can include scenes – which are themselves structures containing actors and things, and relations between actors/things – and answers to questions such as:

- What is going on?
- What is at stake?
- Who are the important actors? What are their roles? How do they relate to each other?
- What is the problem?
- What are possible solutions? What are criteria for ranking solutions?
- What can be expected to happen next?

In this regard, another more intricate operationalization of frame "perceptibility" (formerly "strength") that we conceived of was that the perceptibility of a frame is reciprocal to the number of answers it gives to the aforementioned questions.

Two frames can be compared not only in relation to the number of answers they provide, but more generally in relation to all aspects of their structure. Given frames f1 and f2, we can ask:

- Does f1 answer (some of) the same questions as f2?
- Does f1 mention (some of) the same actors? If yes, are these actors given the same or different (complementary or opposite) roles?
- Does f1 posit (some of) the same problems as f2? If yes, does f1 posit the same or different solutions to these problems? If not, are the problems posed by f1 and f2 complementary or mutually exclusive or in opposition to each other, etc.?

Comparisons of this kind can be used to provide assessments of degrees of overlap, complementarity, or mutual exclusivity of two frames.

5.4.3 Operationalizing Frames

The suggested three axioms above can serve as base for a number of tasks, ranging from basic tasks where two tasks are compared to more complex tasks and applications. Computational systems performing those tasks could assist stakeholders from various fields (e.g., journalists, politicians, speech writers, marketeers, educators).

Task 1 is to measure the effect of framing with all other variables fixed, i.e. we assume two texts with the same frame. The goal is to judge, first manually, then by computer models, which text is stronger. We leave the exact definition of "stronger" open for now.

In Task 2, the goal is to identify whether two texts have the same frame. Our perspective differs from the existing approaches to frame identification such that we do not rely on an existing set of predefined frame types, rather the task is simplified to a binary decision comparing two instances.

The next task, however, makes further assumptions and thus does rely on the availability of frame types. Task 3 is therefore text labeling, i.e. given a single text, does it have frame X? For instance, does this text describe a war as a genocide?

While the previous tasks were inherently classification-oriented, Task 4 is a text generation one. We formulate it as a text rephrasing task. Namely, given a text, we want to reframe it using a frame X. The open question here remains, as in the majority of text generation tasks, how to objectively evaluate the functionality.

Our list of potential tasks also includes an analysis of co-frames, where we allow for multi-label framing of texts, or an ambitious task of identifying whether a text is intentionally framed.

Given the operationalization of framing through a clear task definition, we envision the following applications. First, paraphrasing and reframing can be tailored to specific needs with respect to the audience. As with any other text generation task, a potential dual-use must be taken into account. Second, a writing assistant actively supporting framing or helping reframing a message can be beneficial in the educational context. Finally, an automated tool that highlights frames in a piece of text can help the reader to reflect on the effects of framing.

5.4.4   Corpus Construction for Framing Analysis

Here we outline potential strategies for compiling a corpus of annotated data. Our main presupposition is that we do not define what frames are. We propose selecting reporting on events, as framing influences how we perceive them, such as natural disasters.

Let's exemplify with a set of texts about a volcano eruption. We might observe that some of these events are labeled with extremely opposite frames, such as "disaster" and "tourist attraction". Therefore, starting with a structured database of such events uniquely identified by location and date, we might be able to sample relevant texts from social media or news. This collection would allow us to bootstrap tasks one and two, and also come up with a set of disaster-specific frame types for task three. The reframing task might be constrained in such a way that we would allow annotators only minimal lexical changes that would result in a different frame.