

Formal and Multimodal Approach to Hard News as Genre, Structure and Metalanguage in Social and Digital Media Contexts. The Example of Twitter / *Abordagem formal e multimodal da notícia como gênero, estrutura e metalinguagem em contextos de mídia social e digital. O exemplo do Twitter*

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ABSTRACT

The goal of this paper is to improve heuristics for hard news discourse by proposing a cognitive model of abstraction, regarding social media contexts. To this end, hard news is discussed as a genre, structure and metalanguage, under the formal definition of a semiotic mode. Annotation is a successful technology to control the effects of genre operations, reveal relations, and to inquire about data and documents. It proceeds to characterize Twitter's interface, in terms of formal and material regularities, employed recursively. It further demonstrates the formalization of a semantics for hard news discourse in the so-called logical forms, which has been adapted from analytical tools developed by the Segmented Theory of Discourse Representation (SDRT) in order to examine coherence in different levels of detail. Finally, the implication of this approach as a discipline is discussed, regarding the production of transversal knowledge aiming at digital literacy, which urges in present times.¹

KEYWORDS: Multimodal discourse semantics; SDRT; Annotation; Digital methods; Hard news

RESUMO

O objetivo do artigo é aperfeiçoar heurísticas para o discurso das notícias por meio do desenvolvimento de um modelo cognitivo de abstração, em contextos de mídia social. Para tal, discute-se a notícia como gênero, estrutura e metalinguagem, partindo da noção formal de modo semiótico. A anotação sob essa visada é uma tecnologia bem-sucedida para controlar os efeitos das restrições de gênero, revelar relações e inquirir sobre dados e documentos. Procedem-se à anotação da notícia na interface do Twitter, caracterizada em termos de suas regularidades formais e materiais empregadas recursivamente. Demonstra-se a formalização de uma semântica para o discurso da notícia nas chamadas formas lógicas, adaptada de ferramentas desenvolvidas pela Segmented Discourse Representation Theory (SDRT), a fim de construir novas hipóteses sobre coerência em diferentes níveis de detalhe. Por fim, discute-se a implicação desta

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abordagem como disciplina na produção de conhecimento transversal com vistas à literacia digital, em tempos urgentes.

PALAVRAS-CHAVE: Semântica do discurso multimodal; SDRT; Anotação; Métodos digitais; Notícia

Introduction: The Formal Approach in Multimodality

Multimodality is a semiotic approach of linguistic inspiration, defined in formal terms as “a way of characterizing communicative situations (considered very broadly) which rely upon combinations of different ‘forms’ of communication to be effective.” (Bateman; Wildfeuer; Hiippala, 2017, p.7) The multimodal orientation requires close observation on the context of the practices surrounding genres and the production of artefacts, and communicative situations. It involves examining a ‘conscious’ and ‘controllable’ use of combinations of different resources of expression in a cross-cutting and interdisciplinary fashion.

The definition of semiotic mode is an essential component under the formal approach. Although definitions of a semiotic mode vary according to different approaches and methods that employ it, this paper works with an abstract and formal operational definition. According to such a definition, all semiotic modes combine three (3) interdependent levels: the substrate or material dimension (also entitled canvas, perceived by regularities of form), the technical features organized along various axes of description (syntagma and paradigm) and the level of discourse semantics (Bateman, 2016; Bateman; Wildfeuer; Hiippala, 2017).

According to this approach, a semiotic mode is also defined as a constellation of practices shared among a community of users or professionals, enabling the constitution of meaning in a co-describable manner on three abstract semiotic levels, as shown in figure 1: a perceptible and deformable materiality, which potentially involves multiple sensory channels (canvas); 2) a classification (paradigmatic) of formal units and structures (syntagmatic), which defines the material deformations relevant to the semiotic mode (grammar); and 3) the level of discourse semantics, which provides dynamic mechanisms

for abductive hypothesis construction, and for controlling the processes of interpretation by assigning contextual interpretations to the classifications of the implantable and computable form (Bateman; Wildfeuer, 2014, p.1).

Also according to this approach, discourse is defined at an operational and applied level, that is, commonly equivalent to “text” or resulting from the organization of units into an artefact, namely, clauses, propositions or eventualities.

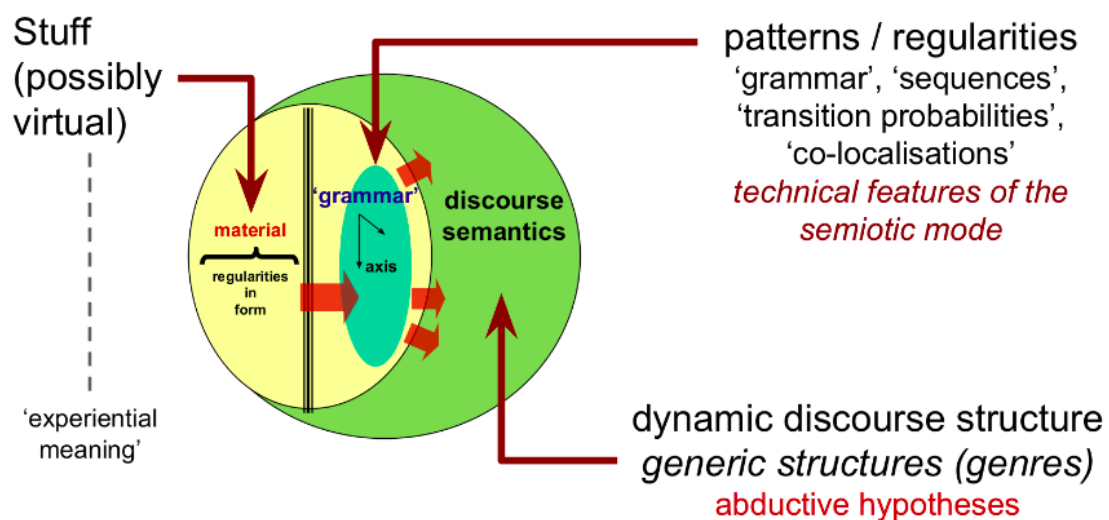


Figure 1: Schematic representation of a semiotic mode.
 Source: Bateman, 2017, p.168, updated by permission of the author.

Such strata which make up a semiotic mode will be treated with scrutiny, taking hard news that circulates on Twitter as an empirical object of analysis. The first section seeks to discuss news as a genre in digital media and social media contexts. If genres of discourse can change, hybridize and colonize each other, the formal and multimodal view provides episteme and methodology to build cognitive models of abstraction in order to characterize the multimodal genre space, aiming to control the effects of genre constraints with enough detail to make visible their variations in time and space.

In the second section, we seek to characterize Twitter’s interface, in the role of reader/user, in terms of its materiality (canvas), modularity (ontology) and *affordances*,

that is, how the interface works or how its communicative properties are regulated. The third section discusses annotation as a fruitful methodological path to design and compute relations (in syntagmatic and paradigmatic axes) and to inquire about the elements (records) of multimodal discourse, anchored in principles of composition and design. Once recursively employed, such technology allows producing cognitive models of scalable abstraction for multimodal news discourse.

Once the material and formal regularities on Twitter's interface have been characterised in the fourth section, it proceeds in section 5, to formalize a semantics for hard news discourse, based on the semantics (and semiotics) of multimodal discourse, which has been adapting and extending analytical tools developed by the Segmented Discourse Representation Theory (SDRT) to provide precise and computable mechanisms and operations on the dynamic aspects of multimodal discourse overall. This paper has adapted the theory and methodology developed by this approach to formalize a semantics for hard news discourse, in the so-called logical forms, in order to build new hypotheses about its coherence at different levels of detail.

Finally, the last section discusses the importance and validation of this approach as a discipline, regarding the challenges in innovation, production and dissemination of cross-cutting knowledge aimed at digital and multimodal literacy.

1 Hard News as Genre and Structure

From a formal and multimodal approach, it is important to discuss the news as genre, since it constitutes a category of a higher order, either as a cultural text, intended to guide possible interpretations (Bateman, 2008), or as forms of combinations of these forms (of language) (Bakhtin, 1986).²

Bateman discusses the existence of genres in dialogue with socio-linguistic and socio-semiotic traditions, which take genre in terms of a relatively stable communicative

² BAKHTIN, M. The Problem of Speech Genres. In: BAKHTIN, M. *Speech Genres & Other Late Essays*. Translated by Vern W. McGee and Edited by Caryl Emerson and Michael Holquist. Austin: University of Texas Press, 1986. pp.60-102.

strategy, endowed with psychological and strategic functions, with goal of “for achieving some relevant social purpose for allowing its practitioners to display that they are attempting to achieve those purposes” (Bateman, 2014, p.239).

Since genres can change, hybridize and colonize each other (Fairclough, Bazeman apud Bateman, 2008, p.10), it becomes important to have models for “characteriz[ing] regions of the multimodal genre space in terms of the traces that they leave in the particular forms and expressive resources employed by the documents that occupy them.”

Controlling the effects of genre constraints would demand a characterization (conducted by annotation as a technology or method) of the concrete forms and contents inscribed in multimodal documents (and here, more specifically, of the news circulating on Twitter) “in sufficient detail to make their variations visible” (Bateman, 2008, p.19).

If genre points to the regularities of the forms, the formal and multimodal approach provides precise operations and mechanisms in order to reconstitute layers of representations by grouping regular elements found in hard news discourse, or registers of discourse, into generically recognizable configurations, which make it possible to distinguish particular genres and types of documents (Bateman, 2008).

Hard news is both, an intrinsically transmedia (ranging across media) and transmodal genre (ranging across semiotic modes). It follows that “any genre may potentially find realization in a range of media and so transmediality is by no means the sole preserve of narrativity” (Bateman, 2017, p.168).

The hard news as a genre of discourse is an industrial product (Lage, 1981, 1987; Genro Filho, 1987), resulting from processes of selection and translation of aspects of “reality,” in conformity with a set of practices and processes shared and reiterated by the interpretative and professional communities. Hard news rely not only on contexts and primary discourses, but also on communicative situations characterized and face-to-face or mediated conversation dialogues, so the result of that selection and translation configures a secondary/reported discourse (Ponte, 2005).

Seixas (2013) tensions purpose, lead and focus as capital categories and notions discussed in theories of journalism and more specifically, in relation with studies of journalistic genres. In the formal and multimodal approach, such notions can be tackled

by observing some conditions of news production (e.g., rhetorical strategy, lead, temporal relations and framing). The author also discusses how the notions of actuality, instantaneity, periodicity, news-value, fact and event could operate in the analysis of journalistic genres, which can be useful for future (virtual) formalizations, because they somehow are implied in the present discussion. In order to understand the path for such characterization, it starts from the formal definition of semiotic mode, therefore, in relation to its material manifestations.

Material regularities extracted from the forms (of production and circulation) of hard news can be mapped (annotated) recursively around the elements pertinent to the canvas, the forms or structure, the registers of hard news discourse (e. g. feature, caption, photo, authorship credit etc.), and even cognitive effects, e.g. *priming* (Iyengar; Kinder, 1987); *agenda-setting* (McCombs, 2006) etc.

In digital media and social media contexts, a scalable instance of hard news as a genre becomes recognisable in the diagram (rhetorical structure),³ that is, as a deformable and computable ‘pattern’ of meanings, as the news unfolds on through a *tweet* to fulfil its rhetorical purpose.

Framing the facts or events⁴ as part of hard news’ production and/or composition would also require the activation of discursive strategies, which are argumentative skills⁵ (Seixas, 2013) intertextual, interdiscursive, in order to frame, that is, “to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation” (Entman, 1993, p.52), and subsequently in the relationship between the news media and its effects (Reese, 2001).⁶

³ The registers of news discourse (e.g.: headline, feature, credits/authorship etc.) guide the interpretation, since they comprise certain formal regularities inscribed in the syntagmatic and paradigmatic axes of hard news discourse.

⁴ Seixas (2013) tensions this in terms of focus.

⁵ And here rhetorical skills (discursive and argumentative) are treated primarily as metalanguage and not a priori as techné.

⁶ Still in his definition, Entman (1993) points out some of the possible functions of *framing*, namely, to promote the definition of a specific problem, causal interpretation, among others. Other authors have dedicated themselves to systematize some of the discursive strategies employed in the production of news and related genres (see Van Dijk, 1988), which are not going to be discussed in detail, due to reasons of space contention.

As the inverted pyramid is structured from the lead, and mapped out, around and beyond, its technical aspects,⁷ decoding it by means of a metalanguage seems to be a “natural” way of transcoding, regarding social and digital media contexts. For that, it postulates the syntagmatic axis of the lead as a result of the combination of discursive referents of the news, structured and/or combined around six questions that need to be coherently articulated: what, who, where, when, how and why (Lage, 1981, 1987).⁸

In digital media and social media contexts, of which Twitter interface is an example, the lead is formalized first as a discourse structure, considering the rhetorical strategies provided by the context in which framings are perceived. The formal approach is then adapted as a cognitive model of abstraction with a view to understand aspects of framing with more precise lenses, ranging from contextually motivated strategies, through regularities of form, and up to variations around expressive resources, as it is intended to demonstrate.

The formal and multimodal approach also guides the characterization of the news as a genre which participates and circulates on Twitter’s interface, besides other material and formal dimensions which relies on ontological principles that regulate the programmatic semiotic modes of the platform, as we shall see below.

2 Materiality on Twitter

From a methodological standpoint, a semiotic mode is a hypothesis dedicated to knowing/explaining how certain material regularities produce certain effects (Bateman; Wildfeuer; Hiippala, 2017). It is not just about physical materiality, but the dynamic

⁷ In journalistic jargon, the inverted pyramid consists of a technique to angle news discourse based on the hierarchy/relevance of an issue or event.

⁸ The Wikipedia entry “Lide (journalism)” (available at: [https://pt.wikipedia.org/wiki/Lide_\(jornalismo\)](https://pt.wikipedia.org/wiki/Lide_(jornalismo)). Accessed on 25 Jun 2022) synthesizes relevant aspects regarding the context in which the lead is discussed in journalism studies and practices. More specifically, it is worth highlighting reviews that (in)directly tell of its praxis, history, function and basic structure, which can be adapted to different languages, journalistic (sub)genres and canvases.

substrate of the perceptual activity with which we engage. According to this approach, not a single semiotic mode shall be considered without attention to its materiality.

The lack of a proper consideration not only of the materiality of semiotic artefacts, but of the semiotic systems employing distinct forms of materiality, has worked against a sufficiently powerful semiotics of multimodality that can be appropriately extended to the visual (Bateman; Wildfeuer, 2014, p.182).

By perceiving the affordances (Gibson, 1979) on Twitter's interface (sub-canvas), one should be able to understand what to do with it or how to manipulate it. Different canvases are able to support different uses and affordances, inscribed in different types of traces.

The canvas contributes to the interpretation of the ways in which the material can be accessed and manipulated. In other words, from the affordances it follows that users and readers build strategies, interact with the interface and its participants, according to the possibilities conveyed by the action programs,⁹ inscribed in and through the platform, such as the comments which allow participants to add multimodal notes and make their contributions in certain communicative situations. It is also very important to perceive the affordances which employ associative possibilities with the canvas, and that can be annotated crosswise. This means that a chatbot incorporates the turn-taking property of dialogic communication, widely studied in face-to-face interactions.

The typology that Bateman, Wildfeuer and Hiippala (2017) develop to characterise the materiality of a semiotic mode is used as a kind of calculation to decide which multimodal tools it is possible to use in order to thus characterize a specific canvas, i.e. to understand how it works and for what purposes.

The reading flow on Twitter's reader/user's interface, for instance, should be characterized in terms of how readers/users "navigate" to interpret the information in the text

⁹ Bateman, Wildfeuer and Hiippala (2017) use the term 'programmatically semiotic modes' to name this instance of regulation.

(i.e. by scrolling on the screen linearly or vertically), from left to right.¹⁰ The typology developed for the canvas also suits the examination of communicative situations on Twitter's interface, which can be characterized in terms of permanence, as opposed to transience.¹¹

The interface further offers the role of participant and/or observer to the Twitter's reader/user, characterized in terms of diegetic (immersed, involved), extra-diegetic (internalised, distant). The (sub)canvases of the interface are considered in the present paper in terms of their two-dimensionality.¹²

On the interface, the typology extends to specifications in terms of ergodic work, which designates whether or how much the reader/user has work in order to perform in or manipulate the canvas in question. Immutable ergodic designates the "amount" of work the reader/user must do to engage with the text. Mutable ergodic, on the other hand, tells from where or how the user/reader can alter the text as which they are engaged.

Such typologies suggest guiding units for the characterization of the structure of news on Twitter, namely, profiles of journalists and/or journalistic organization or companies as publishers of hard news to an intended audience, that is, to whom one is talking. The micro-ergodic work undertaken in the canvas in question, requires the reading/navigating within dimensioned spaces for files (hyperlinks), which can vary between texts of up to 280 characters, image, video, diagrams, graphics, etc., as regular expressive resources (registers of news discourse), which also participate (virtually) in other journalistic (sub)genres.

Although the lack of a more in-depth characterization of Twitter's sub-canvases in terms of their modularity has been duly justified, it is argued that the understanding about the so-called "digital materialities" should be guided also by principles underlying

¹⁰ The flow of reading images is different from the flow of reading verbal texts, according to this approach.

¹¹ A canvas can be further classified as transient, i.e. once something has been said or gestured (e.g. the 'stuff' whether or not it can be inspected again), or permanent, which can be inspected once it has been manifested. When inscribed marks disappear immediately (e.g. spoken language) or vary according to intermediate types until they leave 'permanent' marks (e.g. paper) etc. Transience is important because it can regulate properties of attention and memory during interpretative activity.

¹² The characterization of Twitter on the axis of materiality is complexified due to its modularity. By ontological principles underlying computational reasoning and Object Oriented Programming (OOP), Twitter is modular in essence, i.e. structured in databases, and for this reason it demands separate discussions.

computational reasoning (MANOVICH, 2001),¹³ more specifically ontology (OOO) and object-oriented programming (OOP) (Yoran, 2018), for the reasons further explained.

3 Annotation of Multimodal Discourse

In order to characterize hard news as genre and structure under the formal and multimodal approach, it becomes fundamental to place annotation as an appropriate technology undertaken in the semiotic analysis of multimodal discourse (Bateman; Wildfeuer; Hiippala, 2017) for the construction of metalanguage. In general, annotation makes up a technology and a fruitful methodological path to design and compute relations in diagrams (or to inquire about elements of hard news and documents in general), anchored on principles of composition and design.

In computational linguistics and computer science, annotating means labelling data - images, text or audio - for the purposes of identification, categorization and training of machine learning systems. Labelling, in this sense, refers to computational methods used in scientific research and data science (Kalir; Garcia, 2019).

As a technology underlying computational reasoning, annotation is employed recursively in order to design associative logics that are diagrammatic, scalable and programmatic. Annotation thus involves providing a more or less sophisticated labelling containing the description of elements of the communicative situation/artefact in question, which can be combined, presented or understood (manipulated) according to distinct levels of abstraction (Bateman, 2021).

Such interpretative schemes shall demonstrate how the various modal and semiotic contributions working in articulation to create the perceived meaning or even relations previously “invisible to the naked eye.” Labelling becomes a way to produce metalanguage,

¹³ In this respect, Manovich (2001) translates such principles conceiving databases as a cultural form, and algorithms as ontological entities constitutive of software, despite the importance of disciplines of computer science (and related areas) as a field and discursive formation appropriate to understand and characterise the so-called digital materialities.

as it is also to write computer code, analyze chess games, interpret song lyrics, weave commentaries or identify plot devices and dialogue structures (Kalir; Garcia, 2019).

The use of annotation has been elaborated mainly in the context of linguistic analysis and data labelling, thanks to the use of tools developed and improved in order to annotate complex architectures and data, and then derive scalable interpretative schemes (Bateman, 2021). This would form the material basis of layers of the semiotic modes annotated from hard news discourse on Twitter's interface, organized in terms of significant material regularities of the plans of expression, considering variations of the registers of news discourse combined in the form of diagrams or discourse structures (cf. SDRT). In other words, it is possible to find relevant aspects about the raw data if it has been coded or annotated,¹⁴ so that the phenomenon becomes accessible to the coding and annotation categories derived from a scalable and computable interpretive scheme (Bateman; Widfeuer; Hiippala, 2017).

The formal approach starts from the semiotic modes and resources of complex artefacts. Among possible "measurement" schemes, Bateman (2021, on-line) suggests: video recording, verbal/textual transcription/description, mocap,¹⁵ photograph, image, page scan of a book, geometric model of a page layout, posture, gesture, as long as those are "interpretation-free," that is, they need to be open to articulation as semiotic objects in their own terms: "they *stand for the* empirical object, in some respect, for someone. This means that we can explicitly explore the losses and gains with respect to their objects" (Bateman, 2021). The author explains that good measures or good schemas need to maximize their indexicality. For formally coherent annotation, such schemas must also be constructed or designed in such a way as to achieve the form of diagrams in the Peircean sense of the term.¹⁶

¹⁴ Kalir and Garcia (2019) systematize three type of annotation recursively adopted in this paper (see sections 4 and 5), which work for different purposes, in order to provide different types of information: 1) *Rubrication*, defined historically as ink marks (...) to identify or highlight chapters, sections and headings; 2) *Scholia*: defined as a type of annotation that introduces new information to a text, such as an idea, example or historical reference; 3) *Gloss* - A type of annotation that translates or explains.

¹⁵ Abbreviation for "motion capture."

¹⁶ In this regard, it is useful to resort to the systematization of Machado (2016, p.19): "Peirce understands that diagrammatic logic refers to any iconic system because it is capable of performing graphic, written, drawn and even scribbled gestures (...). In this sense, a diagram is equivalent to an 'icon of a set of rationally related objects' (MS 492:1, c. 1902; apud Pietarinen 2003, p.8), which imprints in diagrammatic logic the ability to establish and develop relations capable of operating expansions in the form of a system of associations possible

In sum, annotation can be coded in terms of regularities observed on the syntagmatic and paradigmatic axes of a discourse (Bateman, 2016), organized in terms of ‘properties,’ ‘entities and relations’¹⁷ (Bateman, 2021) and in terms of which material regularities are relevant, i.e. which make a difference for the production of meaning.

4 Characterising Material and Formal Regularities in the Twitter Interface

One of the great advantages of the methodology undertaken in this approach can also be seen through the results of the accumulation of over 30 years of research on language annotation design. Depending on what one wishes to know about the artefact/genre in question, considerations about the canvas may envisage conditions in terms of its affordances, expressive resources, (bi or tri)dimensionality (Bateman; Widfeuer; Hiippala, 2017; Bateman, 2008), and, in the case of Twitter, its modularity, concerning the role of user/reader.

To that end, we proceed to identify that sub-canvas and the technical characteristics of the content¹⁸ viewed on Twitter by both a participant playing the role of reader/user/consumer, the actions (represented audio-verbo-visually),¹⁹ and configurations of time and space, which follows.

to be represented in the form of graphs. The adjective ‘existential’ which qualifies the graph is justified by its condition of act that emerges from the relations in a present, out of any aprioristic dimension. With this, the existential graphs are proposed as topological notations that incorporate the movement of their evolutions, especially because they are models of self-development.” In Portuguese: “Peirce entende que a lógica diagramática se refere a qualquer sistema icônico porque passível de realizar gestos gráficos escritos, desenhados e até mesmo rabiscados (...). Nesse sentido, um diagrama equivale a um ‘ícone de um conjunto de objetos racionalmente relacionados’ (MS 492:1, c. 1902; apud Pietarinen 2003, p.8), o que imprime na lógica diagramática a capacidade de estabelecer e desenvolver relações capazes de operar expansões sob forma de um sistema de associações possíveis de serem representadas sob forma de grafos. O adjetivo ‘existencial’ que qualifica o grafo se justifica por sua condição de ato que emerge das relações num presente, fora de qualquer dimensão apriorística. Com isso, os grafos existenciais são propostos como notações topológicas que incorporam o movimento de suas evoluções, sobretudo porque se trata de modelos de auto-desenvolvimento.” To know more deeply the role of diagrams in Peircean epistemology, see Stjernfelt, 2007.

¹⁷ By default, that is how a database shall be structured in software.

¹⁸ On the interface, they appear as (multimodal) “file,” arranged linearly for reading or exploration. In terms of their modularity, such files are accommodated, grouped and organized into databases.

¹⁹ Twitter itself allows users to add text descriptions to the image of a *tweet*, which can be read aloud by a screen reader assist technology.



Figure 2: Original tweet from which formal regularities of hard news are mapped out.²⁰ Source: https://twitter.com/ruben_berta/status/1496418417838108674?s=20&t=Y0jiDelhLE7mgnEO5PvQQ.

Participants

- *Role:* On the canvas, a distinction is made between participants versus observers. The first ones, as the name already says, participate in the represented world. By mentioning the profile/id @UOLNoticias in the body of the verbal text, the profile of the journalist

²⁰ The headline and feature published in the journalist's profile is anchored in the strategy of reporting facts/events which could explain Federal Government's flaws, by failing to provide sufficient resources and equipment necessary to the prevention of a natural disaster which happened during and after the heavy rain that hit the city of Petrópolis/RJ, Brazil, in mid-February 2022, causing floods and landslides which resulted in more than 240 deaths. Translated version of the tweet: "I tell in @UOLNoticias today that the stations installed by Cemaden in 9 cities to monitor landslides have been stopped since January 2018 due to the lack of federal funds for maintenance. One of them should work in Petrópolis." Author's own translation.

Ruben Berta (@ruben_berta)²¹ allows the previous profile/id to participate in the represented world (figure 2). As for the observers (readers/users), in turn, the relationship between them and the interpreted material may be partially distant or separate, depending on the semiotic programmatic modes of access and interaction inscribed on the interface.²²

- *Space and time configurations*

Date and time of the tweet publication: This action is coordinated with the content, as it allows to control the temporal flow of publishing *tweets* and *threads*.²³ This unit is crucial to analyze dynamic situations as time and discourse unfolds. For the reader/user role, it is characterized as immutable micro-ergodic.

Grid: Technical characteristic presented in the interface which defines the dimensionalities of the contents inscribed on Twitter's interface (and sub-canvases). Variations of this unit are commonly found in several structures of organization and hierarchization of news in different media, including analogical ones.

- *Content*

Content: Bateman and Wildfeuer (2014) make distinctions between the units of the canvas, and what is inscribed in the material (content). Twitter accommodates a variety of content that can be accessed (i.e. in the role of reader/user), ranging from written language, photography, illustrations, to audiovisual media or diagrams, among others, therefore accommodating variations in reading and navigation flow. For the reader/user's role, this unit could be characterized as linear (reading/navigation) or immutable micro-ergodic.

²¹ In the Twitter interface, the role is represented twice: 1) the logo (visual), followed by the full name of the profile written in verbal text (Folha de S. Paulo and Ruben Berta); 2) the profile address in verbal text, preceded by the symbol @ (at). When moving the cursor over any of these items, Twitter displays another sub-canvas (*box*), containing more information about the analyzed profile.

²² The profile of the journalist or organization in question (participant) can configure the canvases which regulate the access and interaction of readers and users with the profile in question.

²³ To follow the reading flow of a *thread*, the reader/user must click on "Show this sequence" link (verbal text), by default, located just below the actions inscribed on the canvas cited above, in order to access and visualize the sequence of *tweets* published by the participant profile. In addition, the interface visually represents the sequence of *tweets* that make up the thread (gray), located on the left side of the box (content).

URL: Technical characteristic subordinated to the content. Hyperlink to which the content represented in the interface is linked.²⁴ In the analyzed sub-canvas, it can be accessed and characterized as linear (reading), or immutable micro-ergodic.

- *Actions*

Comment: In the role of reader/user, the sub-canvas in question is characterized as mutable ergodic.²⁵

Retweet: This sub-canvas is characterized both as mutable and immutable ergodic, in the sense that the user can add a message over the replicated (retweeted) message produced by the participant (journalist profile), adding complementary content/hyperlinks.

Like: In the role of the reader/user, this sub-canvas is characterized as immutable micro-ergodic, as the user's action boils down to liking the posts (through a click) that appear on the screen.

Just right above the actions aforementioned, it is possible to see the quantities in which such actions were carried out by participants/followers of the profile in question on that content.

²⁴ On Twitter's interface, this item is represented by a double pattern: 1) as an electronic address (URL) written in verbal text; 2) as a headline of the news item (register of discourse).

²⁵ In this regard and using Instagram as an example, Bateman, Wildfeuer and Hiippala (2017) explain that the action of commenting accommodates an ergodic and mutable communicative situation, which takes the form of a multimodal dialogue, in which it is possible to use written language, emojis, hashtags, and in the case of Twitter, gifs, as expressive resources. For the full reference of the work, see footnote 01.

hard news discourse on Twitter.

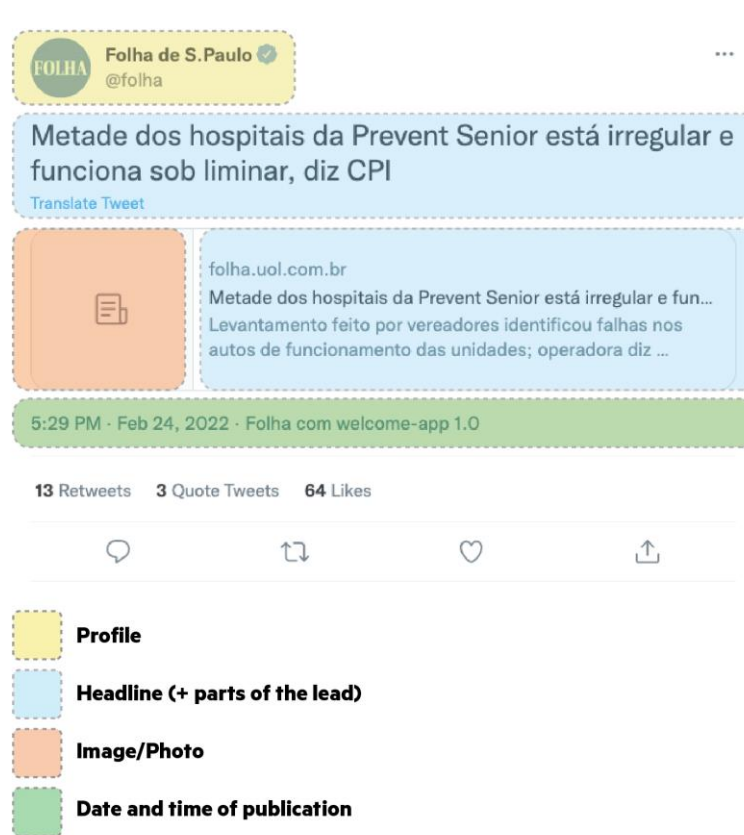


Figure 3: Print of Twitter's interface, published on the profile of Brazilian news media, *Folha de S. Paulo*,²⁶ for the role of user/reader and Synthesis of the formal regularities (registers) of Source:

<https://twitter.com/folha/status/1496945310786015236?s=20&t=Y0jiDeIhLE7mgnEO5PvQ0Q>.

Last access: 12 Jul 2022. Author's own elaboration.

Formal regularities of hard news on the interface for the reader/user role are codified here considering the employment of combinations of expressive resources, and more specifically, of registers of the news discourse, which regularly participate in other journalistic (sub)genres. In this sense, layers of description are added in terms of units

²⁶ Translation of the tweet: "Half of Prevent Senior's hospitals are irregular and work under preliminary injunction, says CPI." Authors own translation. Further semantic description will be constructed from the English version of this tweet, in section 5. The news is structured from a investigation carried out by city councillors of São Paulo, Brazil, which attests irregularities in the operation records of half of the 14 hospitals administered by Prevent Senior health operator, which at the time was investigated by the Parliamentary Investigation Commission (CPI) in São Paulo City Council.

(entities) regularly employed in the syntagmatic and paradigmatic axes inscribed in the plane of expression and composition. The following ones are highlighted:

Profile: Represented by the profile icon: a) journalist (Figure 2); b) companies or journalistic organisations (Figure 3).

Headline: This item appears twice²⁷ in figure 3. In figure 2, the headline is also noted as a register of discourse, and part of the lead, as a rhetorical structure, since such referents consist of accessibility components, so that the discourse can be updated, according to the scheme and model presented here and which we will deal with later in detail.

Photography/Image: Since images may afford a variety of reading and interpreting patterns, this paper proposes the semantic description model adapted from comics (Wildfeuer, 2019) and sequential art (Bateman; Wildfeuer, 2014), adapted for photography, to formalize a semantics of multimodal news discourse, in the so-called logical forms, as further seen in section 5.

(Parts of the) lead: From an ontological standpoint regarding social and digital media contexts, variations of the lead could be modular or scalable (diagrammatic).²⁸ This means that a rhetorical structure may serve as narrative axis (diagram) in order to modelize dynamic structures for news discourse,²⁹ as section 5 shows.

Date and time when the tweet was published: Such discursive referents are fundamental control conditions for inferring heuristics for hard news discourse, as seen in section 5, because these depend on concrete references about the temporal and spatial contexts in which the news was produced, or published, as a *tweet* or as a *thread*.

²⁷ When it appears for the second time, by *default*, the headline is represented as a hyperlink.

²⁸ An example which explains the phenomenon is described in the article entitled “Journalism in software” (“Jornalismo em software”), published in the column of journalist Pedro Dória, in the newspaper O Globo, in 2012 (online).

²⁹ In this regard, see the interactive infographic produced by the North-American newspaper The New York Times, entitled *Tracking the Oil Gulf Spill*. The narrative (data) structure of the visualization is assembled from the articulation between text, image (map) and hyperlinks, which unfold dynamically. Available at: <http://archive.nytimes.com/www.nytimes.com/interactive/2010/05/01/us/20100501-oil-spill-tracker.html?> Accessed on 25 Feb.2022. The video published on the Instagram profile of the British newspaper *The Guardian*, in turn, combines audio-verbal resources and registers of news discourse, namely: statements by the US President at that time, Donald Trump (source), between January 30 and March 17, 2020, which unfolds dynamically, in parallel relation to the increasing numbers of Coronavirus cases in the country (parts of the lead). Available at: https://www.instagram.com/tv/B97ENsnqaPm/?utm_source=ig_web_copy_link. Accessed on 25 Feb.2022.

By characterizing the material regularities of Twitter's reader/user profile interface, and of the forms of news discourse, one can produce the material and methodological basis of everything that follows, according to this approach.

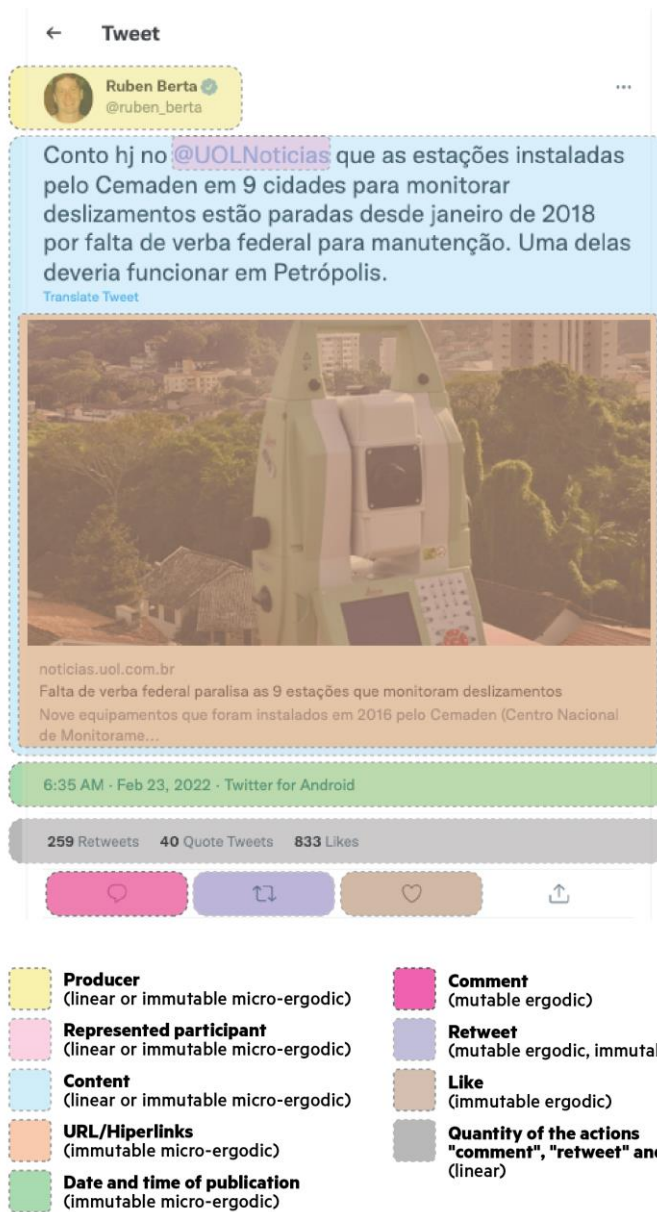


Figure 4: Annotation of Twitter interface sub-canvas, for the role of reader/user, according to the typology of affordances proposed by Bateman, Wildfeuer and Hiippala (2017) on 24 Feb. 2022. Source: author's own elaboration.

5 Semantic Description for News Discourse

Multimodal discourse semantics is a “pragmatically grounded theory of multimodal discourse” (Bateman; Wildfeuer, 2014, p.185) which has been adapting and extending analytical tools developed by *Segmented Discourse Representation Theory* (SDRT, cf. Asher; Lascarides, 2003), in order to explore “how meaning can be dynamically constructed in discourse, even when that discourse involves multiple modalities” (Bateman; Wildfeuer, 2014, p.194).

Because SDRT has developed a more or less stable set of discourse/temporal relations as analytical tools, it provides precise mechanisms and operations on dynamic aspects of discourse (and here adapted to multimodal hard news discourse) in order to enable the construction of logical forms for building new hypothesis about coherence at different levels of detail.

This theory relies on abductive and defeasible reasoning processes on the best interpretation (or pragmatic preferred interpretation, cf. SDRT), based on the addressee’s cognitive ability to logically combine the information available in the discourse with other sources of information. The logic of multimodal discourse interpretation relies on a general semiotic framework which supports the examination of how various semiotic resources operate intersemiotically, and the particular significance that each separate resource has for the inference process (Bateman; Wildfeuer, 2014).

This general semiotic framework is called the logic of information content, the first individual logic and the main focus of the present section. This logic provides a formal language to analytically construct a semantic representation of multimodal hard news discourse in the so-called logical forms.

SDRT provides descriptive logical and analytical tools for formalizing and computing patterns of meaning construction, giving rise to dynamically produced “structures” which allow testing and predicting consequences for discourse interpretation, particularly in terms of accessibility of discourse referents, that is, which referents should or should not be accessible or make a difference to the inference.

This theory was conceived/designed on the basis of several distinct logics, which combine to form “an overall ‘logic of discourse interpretation’” (Bateman; Wildfeuer, 2014, p.186), capable of producing cognitive models of linguistic abstraction, performed by means of simple and complex operations and oriented towards general problem solving.

Discourse interpretation consists of a number of distinct tasks: constructing a logical form of discourse; reasoning about the consequences of that logical form; reasoning about lexical meaning; reasoning about the consequences (in terms of the speaker’s propositional attitudes) of the speaker being a rational and cooperative agent. We believe that discourse interpretation is best shaped by various logics that ‘interact’ between logics designed to accomplish one of these specific tasks (Asher; Lascarides, 2003, p.80).

The logical form of hard news, or “first logic,” (of “information content,” cf. SDRT - main focus of this section - is constructed as abductive and defeasible reasoning,³⁰ that is, within non-monotonic logics, as more information becomes available and dynamic interpretations of the discourse may change. The first logic of hard news content is formalized and adapted, thus, considering a more general principle according to which readers will build hypotheses, inferences and representations that will be confirmed or not, as discourse dynamically unfolds.

Given that the goal of this section is to focus on the interaction of inferences and material units (Wildfeuer, 2019) inscribed in hard news discourse which circulates on Twitter’s interface, it is taken into account the very small material units, as it is the case of hard news formatted or configured as a tweet or a thread, and its interpretation by the reader/user. In this case, one can compute the path of interpretation in more detail and

³⁰ Peirce (*CP* 5.171) discusses as many definitions of abduction as necessary. However, and considering the context and the area of research with which this article dialogues, it is worth mentioning the following definition, in relation and comparison with other types of reasoning systematized by the author: “Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea; for induction does nothing but determine a value, and deduction merely evolves the necessary consequences of a pure hypothesis. (...) Deduction proves that something must be; Induction shows that something actually is operative; Abduction merely suggests that something may be.”

more explicitly, by describing the inferences necessary for interpretation, in order to specify and restrict the relationships with its material units.

In SDRT, a logical form for discourse interpretation operates by constructing a (dynamic) semantic representation for each discourse contribution received, specified as clauses or eventualities, connected by a more or less stable set of discourse relations – also called temporal or rhetorical relations - arranged in the form of default axioms in a growing discourse structure (cf. SDRT).

In other words, the progressive interpretation of hard news discourse on Twitter (regularly materialized as a tweet or thread, that is, a sequence of interrelated *tweets*) operates by combining individual semantic specifications with the appropriate rhetorical relations, provided by SDRT as default axioms.

This is the first analytical tool with which we specify the rules for inferring the rhetorical relation that connect eventualities, as discourse is (virtually) added, as Asher and Lascarides (2003, p.199) formulate: “These axiom schemata in general take the form of (7): (7) $(\alpha, \beta, \lambda) \wedge \text{some stuff} \rangle R(\alpha, \beta, \lambda)$.”³¹ This rule can be described as follows: if there is a non-specific relation, represented by \rangle , between segments α and β in context λ ³² in conjunction (\wedge) with some material then normally³³ the rhetorical relation between α and β can be inferred in context λ .³⁴

In order to construct the first logical form for hard news discourse, the default axiom both specifies precisely what information the context must provide (or be accessible to) in order to infer rhetorical relations between the eventualities, and to specify the discourse properties regarding the elements being related: “The semantic scope of a presupposition depends on which part of the context the presupposition binds to with a rhetorical relation.” (Lascarides; Asher, 2007, p.12) The mechanisms and operations of inference are then described as abductive and defeasible reasoning, by ‘gluing’ the logical

³¹ The authors use “some stuff” as an existing condition for a rhetorical relation between α and β to hold, in order to assert an evidence for the relation.

³² λ represents the semantic context in which α and β are embedded, which includes the reader’s knowledge of the world when β is presented.

³³ “Then normally” is an operation represented by \rangle that characterizes inference by abductive reasoning.

³⁴ An example of how this axiom applies to news discourse on Twitter will be discussed below.

forms together, in order to maximize discourse coherence (Asher; Lascarides, 2003, p.184, 230; Bateman; Wildfeuer, 2014).

Meaning postulates are another analytical tool undertaken here to formalize the semantic description for hard news discourse in its first logic, by postulating variations of the lead as discourse structures and discourse referents. With this tool, we can specify harder constraints which need to be met from context, and to be related by means of a rhetorical relation.

The meaning postulates are defined, therefore, as monotonic, (non-abductive) constraints, as Asher and Lascarides (2003, p.159) formalize: “All the meaning postulates will be of the form given in (27) (for various values of R), where conditions (α, β) will express some particular conditions on $K\alpha$ and $K\beta$, or on discourse referents introduced by $K\alpha$ and $K\beta$: $\varphi R (\alpha, \beta) \Rightarrow \text{conditions } (\alpha, \beta)$.”

Although the focus of the section is not dedicated to the second logic (“information packaging and discourse updating,” cf. SDRT), it is important to mention that the formalization of the news discourse in its first logic enables further formulations in terms of discourse updating procedures (Asher; Lascarides, 2003, p.212), which takes discourse segments as inputs to be added, considering the rhetorical relations established in the production of individual Segmented Discourse Representation Structures (SDRS), which compute the result of the updating.

The approach uses the syntax and semantics of a formal language, in order to construct and represent the logical forms, and specify the constraints on knowledge of the context, when computing the rhetorical relationships across segments and structure. Logical forms are represented as Discourse Representation Structures (DRS), usually labelled K_i and written using a ‘box-style’ DRT notation, as summarized in Table 1. DRSs are equivalent to clauses, and summarized as mini-texts. These structures group discourse referents (shown as variables at the top of each box) into single ‘accessibility domains’ for further operations, as discourse may develop into updated procedures (Bateman; Wildfeuer, 2014).

The semantic description is then extended to compute visual modalities and is always described as a defeasible, abductively inferred eventuality, annotated as $\varepsilon\pi$

(Wildfeuer, 2019). For the description, sub-eventualities are the minimal semantic units which can be taken as a starting point to formalize the logic of information content of hard news discourse.

$e\pi 1$ = tweet 1				
$e\pi 1a$ ~ published (speaker)	$e\pi 1b$ ~ half...irregular	$e\pi 1c$ ~ and work...injunction	$e\pi 1d$ ~ says CPI	$e\pi 1e$ ~ Prevent Senior forefront
technical features [v] logo (a) [t,a] profile/hyperlink (b) [t,a] Id/hyperlink (c) [t,a] 24/02/2022 (d) [t,a] 17:29 (e) ta#17:29 a, b, c, d ~ profile (speaker) published $e\pi 1a$	[t] "half...irregular" (f) tb # unknown f ~ half...irregular $e\pi 1b$	[t] work...injunction (g) g ~ work...injunction $e\pi 1c$ tc before tb	[t] says CPI (h) h ~ says CPI $e\pi 1d$ td before tc	[v] building forefront (i) [v, t] "REVENT..." (j) [v] trees (k) [v] houses [l] [v] "no parking" [m] you# unknown i, j ~ Prevent Senior forefront $e\pi 1e$

$e\pi 1a, e\pi 1b, e\pi 1c, e\pi 1d, e\pi 1e$ | ~ tweet 1 ($e\pi 1$)
 rhetorical relationship: $e\pi 1a, e\pi 1b$ | ~ narration³⁵
 rhetorical relationship: $e\pi 1b, e\pi 1c$ | ~ elaboration
 rhetorical relation: $e\pi 1d$ | ~ background
 rhetorical relationship: $e\pi 1e$ | ~ narration

Table 1: Semantic description of information content of hard news published on Twitter's interface on (by) the profile of Folha de S. Paulo (see Figure 3).

Source: Own preparation.

In summary, we specify five sub-eventualities that form the eventuality $e\pi 1$, as shown in Table 1, labelled $e\pi 1a, e\pi 1b, e\pi 1c, e\pi 1d, e\pi 1e$, as an abstract representation of the inference about the content of the sub-eventualities in the discourse. The notation [t] of $e\pi 1b$ | ~ specifies that it is in the textual modality that "half of Prevent Senior's

³⁵ Given that the space devoted to discussing each of these rhetorical relations in formal terms is insufficient, and in order to distinguish them from other approaches that employ homonymous rhetorical relations, for explanatory purposes, we define each of them informally below.

hospitals” is described with the logical operator $| \sim$, as a narration relation. The temporal referent t is labelled as unknown in this case.

$\epsilon\pi 1b$ is described according to the discourse referent marked in a textual modality (t), labelled as (g) and so on for the remaining sub-eventualities. This means that it is in the textual modality that the clause inscribed in the *tweet* promotes the inference of the predicate $| \sim$ “and work under preliminary injunction,” thus representing, in abstract form, the proposition of $\epsilon\pi 1b$. The logical form of this inference is encoded in the table row as $g | \sim$ and work under preliminary injunction ($\epsilon\pi 1b$). Again, the logical operator $| \sim$ indicates that the consequent (reasoning) of the logical equation is defeasible (non-monotonic).

Potential analytical units are perceived in the thumbnail image to build new hypotheses for the interpretation of the multimodal discourse in order to place these visual units in a motivated structure (Bateman; Wildfeuer, 2014). Thus, we adopt the semantic description model for comics developed by Wildfeuer (2019) in order to map and formalise the expressive resources inscribed in the analysed image. It is useful to point out that referents (k) and (l) are not relevant visual components for the context in which they appear, since they make no difference for inferring $\epsilon\pi 1e$ considering the segments that precede it in the headline. On the other hand, labels (i) and (j), represented in the visual modality [v], are mobilized by gestalt principles for the forefront of Prevent Senior’s building (i), on whose sign is seen inscribed “PREVENT SENIOR” from bottom to top (j), i.e., an iconic, conventionalized semiotic material (Bateman; Wildfeuer, 2014) to infer $\epsilon\pi 1e$. The temporal relation between the sub-eventualities is specified in Table 1, in a sequence of narration,³⁶ elaboration,³⁷ background³⁸ and narration ($\epsilon\pi 1$).

With semiotic and semantic analysis of multimodal discourse, we can demonstrate how dynamic semantics are coupled to variations of news structures, in articulation with

³⁶ Narrative. “Informally, this relation holds if the constituents express eventualities that occur in the sequence in which they were described. It can connect indicatives or requests.” (Asher; Lascarides, 2003, p.462) Example: Narration (10a, 10b) and Narration (10b, 10c). (10) a. Max entered the room. b. He sat down. c. He lit a cigarette.

³⁷ Elaboration. For the formal description and temporal consequence of this subordinate relation, see: Asher and Lascarides, 2003, p.461. Example: (8) Max had a lovely meal last night. He ate lots of salmon.

³⁸ Background. “This relation holds whenever one constituent provides information about the surrounding state of affairs in which the eventuality mentioned in the other constituent occurred.” (Asher; Lascarides, 2003, p.460).

the registers of news discourse and semiotic modes which accommodate news (sub)genres, demarcating the intended range of interpretation of these forms. We extend SDRT box-style notation to compute visually provided information, such as the results of Gestalt visual processing, and of the abductive identification of expressive devices (Bateman; Wildfeuer, 2014). The discourse referents given in $\epsilon\pi\lambda\epsilon$ explicitly list the multimodal composition and contribution of visual modalities, marked as [v], in order to specify the interpretation path of the abducted elements.

Final Considerations

The last section summarizes important aspects about how the formal approach plays a much broader role than what has been explored earlier, regarding heuristic refinements for multimodal news discourse.³⁹

If abductions on the news as a genre should vary in terms of pragmatically conscious relations between “semiotically charged” materials, it is possible to claim that the paper makes a considerable effort to specify and map mechanisms and operations which enables to virtually project, control/restrict and compute effects and the path of interpretation of the news, so as to make visible its (sub)generic variations.

To this end, a sub-canvas of the Twitter interface was located and mapped in the reader/user profile, with the goal to spot combinations and multimodal configurations which regulate the functioning and actions engendered in/through the platform, without losing sight of its ontological condition, recursively employed as a cognitive model of scalable abstraction for multimodal news discourse.

The regularities of form was mapped, since it is inscribed on the interface as registers of news discourse which participate in other journalistic (sub)genres. As a discourse structure, empirically tested hypotheses can be built on discourse updating procedures, such as experimental and analytical predictions for interpretation, packaging and updating of information content (cf. SDRT).

³⁹ See for example: Bateman; Delin, 2007.

Finally, the formalization of a semantics for news discourse in the so-called logical forms is demonstrated, adapted from analytical tools developed by *Segmented Discourse Representation Theory* (SDRT), in order to build new hypotheses about news coherence at different levels of detail. Up to this point, it is hoped that there is no doubt about the innovative contribution of multimodal discourse semiotics and semantics anchored in SDRT. Such approach provides pragmatically and empirically testable interpretive mechanisms and operations necessary “(...) for relating the forms a semiotic mode distinguishes to their contexts of use and for demarcating the intended range of interpretation of those forms” (Bateman; Wildfeuer, 2014, p.183).

As a mediating stratum of news discourse, multimodal discourse semantics provides refined mechanisms in order to relate particular segments of “semiotically charged” material to their contexts of use, so that it is possible to derive precise mechanisms and operations on the rhetorical strategies provided by the context in which news framings are or have been perceived.

In summary, the formal approach is adapted here with the goal to understand aspects of news discourse and frames have been perceived through a more precise lens, ranging from contextually motivated strategies, regularities of form, to variations in expressive resources, in which such an approach has proven successful. Particularly important here is the validation of appropriate levels and contexts of news frames (argumentative force).

Finally, the paper seeks to demonstrate the recognition and innovation of this approach as a discipline, aiming at the production and dissemination of transversal knowledge, as well as at the (re)formulation of didactic-pedagogical strategies aimed at digital literacy, in urgent times.

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Reviews

Due to the commitment assumed by *Bakhtiniana*. Revista de Estudos do Discurso [Bakhtiniana. Journal of Discourse Studies] to Open Science, this journal only publishes reviews that have been authorized by all involved.

Review I

The article is quite relevant and current, for presenting a methodological proposal of multimodal analysis of journalistic content published on Twitter. The proposal is very well formulated, anchored in a solid and interesting theoretical basis, well suited to the object.

The text, sometimes, even due to the characteristic of the theoretical-methodological model, becomes a little abstract at times, so that it is interesting to intensify the association with examples of analysis, in order to make it more accessible. Besides that, it is worth making a grammatical review, for brief corrections. In the Word document, I indicate the suggested changes. APPROVED WITH SUGGESTIONS

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Research Data and Other Materials Availability

The contents underlying the research text are included in the manuscript.