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The Logics and Semiotics of Discourse Relations in Comics

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Summary. This article aims to point out some of the specificities of an approach that understands discourse relations in comics within a broader conceptualization of multimodal discourse. It lays out the theoretical foundations of these relations in philosophy, semiotics, and logic, and showcases how a small and concise set of these discourse relations can explain processes of reasoning in the interpretation of a comic.

Keywords. Discourse relations, logics, semiotics, multimodal discourse, reasoning

Zusammenfassung. Dieser Beitrag diskutiert Besonderheiten des analytischen Zugangs zu Diskursrelationen in Comic im Kontext multimodaler Diskursanalyse. Er legt dafür zunächst die theoretischen Grundlagen dieser Diskursrelationen in Philosophie, Semiotik und Logik dar und veranschaulicht dann, wie ein relativ kleines, gebündeltes Set von Diskursrelationen es ermöglicht, unterschiedlichste Interpretationen und Schlussfolgerungen in der Interpretation von Comics nachzuvollziehen.

Schlüsselwörter. Diskursrelationen, Logik, Semiotik, multimodaler Diskurs, Schlussfolgerung

1. Introduction

In my previous work on comics and graphic novels together with John Bateman (Bateman and Wildfeuer 2014a, b), we have characterized sequential visual narratives as a form of multimodal discourse which is interpreted dynamically by inferring d i s c o u r s e r e l a t i o n s between segments. From a linguistic and multimodal analytical point of view, these discourse relations are usually treated as semantic relationships that build coherence between different entities within a panel or across several panels and so account for the discursive (and in many cases narrative) structure of the comic strip or page.

Many different approaches in comics studies have theorized about similarly meaningful relations between units of image and text, including Scott McCloud's fundamental work from 1994 as well as several other, diverse perspectives (e.g. Cohn and Bender 2017; Harris 2007; Saraceni 2000; Varnum and Gibbons 2001; Wartenberg 2012). In fact, the aim to describe relationships between elements in a comic has been a "central theoretical concern of comics studies" (Spanjers 2021: 81), and Spanjers' recent overview has demonstrated once again the diversity of approaches that have been employed to address it. Whereas the author himself goes back to the much discussed 'Laokoon' by Gotthold Ephraim Lessing (1990 [1766]) as a central starting point and draws connections to Roland Barthes as well as W.J.T. Mitchell, particularly d i s c o u r s e -oriented approaches to this debate that put a focus on the textual and discursive characteristics of comics are rarely mentioned in this and other overviews.

For a multimodal analysis of comics, this is interesting, especially given that the immensely growing context of multimodality studies has provided many different frameworks for the analysis of visual artifacts as discourse, both from a functional as well as a formal perspective. These works often go beyond discourse theories into philosophy proper, not only taking into account advancements from discourse studies and discourse semantics, but also integrating some fundamental features and concepts from semiotics and logics (see also Bateman 2021; Wildfeuer 2021).

This article connects to that latter kind of comic theory. It aims to point out some of the specificities of an approach that understands comics discourse relations within a broader conceptualization of multimodal discourse. It lays out the theoretical foundations of these relations in philosophy, semiotics, and logic, and provides an integrated view of multimodal communication in general and in comics in particular. While the main part of our previous work has been focused on the notion of multimodal discourse (not least in contrast to the concept of a visual or multimodal grammar, see Bateman and Wildfeuer 2014a) and has approached the theory of this discourse from a linguistic point of view, this paper goes back to its origins explaining the connections drawn between logic, semiotics, and discourse theory. Beginning by highlighting the specific characteristics of a logical conceptualization of discourse relations and their semiotic treatment as a result of abductive inferences about the meaning of multimodal artifacts, I trace these ideas back to general philosophical theories of understanding and meaning in order to provide insights into how comics work similarly to verbal discourses – namely through basic principles of connections between thoughts.

An important aspect on which I aim to elaborate in this discussion is the fact that the approach of analyzing discourse relations in comics is not only applicable to purely 'narrative' types of this media genre, but equally allows for the examination and explanation of other communicative purposes to which comics are employed as discourses. This is particularly interesting and important with regard to the current trend of establishing comics in many different educational, persuasive, and instructional contexts. Bram-

lett et al. (2016) for example list eleven different, narrative and non-narrative comics genres, including autobiographical and journalistic comics; so-called 'metacomics' that play with their self-referentiality (cf. Cook 2012) or 'instruction comics' that give first-aid instructions in the form of a poster (cf. Wildfeuer et al. 2022) are just two more example genres to be mentioned here. A multimodal analysis of these different comics genres aims at a relatively neutral and thorough analysis, examining foundational and general properties of the communication form as such. Whether these genres fulfill more specific functions in the form of a narrative, an argument, or an instruction, for example, can then be examined more precisely with specific methods such as the identification of discourse relations. With the case study below, I aim to analyze an example from the educational context of health communication in order to demonstrate the breadth of the possible applications of such analyses of discourse relations.

The centerpiece of this paper will therefore consist of a small and concise set of discourse relations that are seen to hold between several elements and structures in comics (see section 2). The remaining parts of this paper will then provide a discussion of the basic principles underlying the conceptualization of discourse relations as logical and semiotic entities (see section 3) as well as a demonstration of the straightforward applicability of this set and the relations as a fruitful, hands-on method for the analysis of comics and graphic novels (see section 4). The conclusion in section 5, finally, will briefly discuss how this analysis contributes to comic theory as a whole.

2. Discourse relations in comics and graphic novels: a general overview

In his discussion of the general relationship between text and image(s) in many different communicative artifacts, Bateman (2014: 205–222) gives an overview of the main models of discourse and resulting classification schemes for image-text relations. He demonstrates applicability to diverse multimodal documents, including comics and graphic novels. Bateman also explains the general principles underlying this analytical approach:

> Regardless of framework, discourse is generally considered to be made up of 'discourse moves' of various kinds that serve to advance the communicative goals pursued by a speaker or writer. Since communicative goals are rather abstract, it is then natural to think of whether linguistic expressions are the only ways of achieving them. [...] Multimodal accounts of discourse consider whether particular proposals for discourse organisation can be extended with images taking on some of the roles of discourse moves [...] (Bateman 2014: 206).

The ability of images to take on roles of discourse moves covers many processes initiated by a discourse in the course of constructing meaning, including some that are not visibly or explicitly expressed in the artifact itself. This

is taken up in more explicit accounts of comics as multimodal discourse (see also Jacobs 2013; Feng and O'Halloran 2012; Forceville et al. 2014; Tseng and Bateman 2018). They develop the idea from verbal discourse analysis further and adjust it for all visual units in comics discourse. Our work provides an overview of how these discursive principles are at work on different levels of comics, and how they keep the comprehension and further processes of interpreting a comic going (Bateman and Wildfeuer 2014a, b). In the following, I want to illustrate these discursive principles through one short example.

Fig. 1. From *Mental Load* (Emma 2017: 106).

Figure 1 shows a passage from Emma's *Mental Load* comic (2017) in which several discourse relations can be identified between the various segments, constructing a coherent piece of communication. Discourse analysis can show where exactly these discourse relations can be inferred, for example between several verbal units or between verbal and visual units. For instance, the sentences in this extract are connected by so-called 'Narration' relations, since the events they express (going to the office, sitting down, getting a coffee, coming back) can be seen as happening in a temporal and spatial sequence. The final sentence, in contrast, can be seen as presenting some sort of Enhancement of the tasks that are mentioned in the previous sentence, and the discourse relation inferred as holding between the two sentences is then also usually called Enhancement or Elaboration. The visual part of the extract, the image of the woman with her bag, can also be connected to some parts of the text: The image illustrates details of the events of 'getting to the office' and 'taking one's place,' and details presented in this manner are usually inferred to be a part of some-

thing else, so holding a part-whole relationship, which is usually called Part-of. Quite similarly, the speech bubble to the right of the woman represents an utterance that is related to the event of sitting down and, possibly, greeting some colleagues, although the latters' presence is not expressed verbally. It thus adds even further details and may also be seen as an Enhancement/Elaboration. So we have already identified several discourse relations between the various segments that render the whole a coherent piece of communication. That whole can then also be related to preceding and following parts of the comic as a larger narrative.

This short and rather informal discourse analysis has shown how meaning can be constructed, or 'made', out of relations between various elements in comics. While several frameworks and approaches are available that define discourse relations in comics and visual artifacts more specifically, also including non-narrative discourses (see, e.g., Martinec and Salway 2005; Liu and O'Halloran 2009; Feng and O'Halloran 2012), the analysis here has described only a few of these and on the basis of some very general principles of understanding. For instance, we usually expect stories to be told in a temporal sequence and we therefore expect that things and events in the story connect in a sense-making, logical, and temporal manner. At the same time, we often look for causes and purposes or oppositions and contrasts holding between two different ideas, and we know that sometimes two things or ideas are juxtaposed in order to show their similarities. Even if specific frameworks label the relations differently[1], there are some general principles at work, certain 'logical relationships' that are usually used in communicative artifacts to connect two ideas.

Some very general descriptions of such relationships are often doubled in writing tutorials, where the connection between ideas plays an important role. Writers are then asked to use logical connectors to combine sentences in a text or to build the structure of their texts on these logical relations, even if they are not explicitly expressed. Connections between logical and discourse relations have been most systematically developed in text and discourse linguistics, and especially in formal or functional discourse analysis. On this basis, we have previously presented (Bateman and Wildfeuer 2014a) a set of formalized discourse relations specifically defined for the semiotic mode of comics and with the purpose of analyzing meaning-making processes between units in comics and other visual artifacts. Similar, but in most cases less formalized overviews of these relations have been provided in other works in the context of multimodality research.

In Table 1, a broad summary of the main discourse relations that have been identified in these accounts over the years is given. The list only features the most frequently used relations that are commonly defined as being identified within several types of static artifacts. It builds on the sets of relations provided in Bateman and Wildfeuer (2014a), an even smaller set given in Packard et al. (2019) as well as the basic set of relations that has been defined by Asher and Lascarides (2003: 146) for both narrative and expository texts. The latter, for example, justify this limited set of relations by vir-

tue of the relations' truth conditional effects. Their choice is therefore always motivated by semantic interpretation. The set also includes parts of the main relations identified by van Leeuwen (1991) for film and by Liu and O'Halloran (2009) for text-image combinations more generally. Most of the artifacts analyzed so far have been fictional stories, mainly with a narrative function, telling a clear story and not serving any other communicative purpose. However, earlier accounts of verbal discourse analysis have already highlighted the applicability of this set to other text types, for example in the broad framework by Asher and Lascarides (2003) that also includes the analysis of professional conversations and disputes.

Tab. 1. Discourse relations in comics and graphic novels.

RELATION	NECESSARY CONDITIONS
Enhancement/ Elaboration	specification of an event/state/object by another event/state/object
Property	indicated property of one event/state/object is applied to the other event/state/object
Part-of	part-whole relationship between two events/states/objects in a sequence
Contrast	structural similarity, but semantic dissimilarity between two events/states/objects
Parallel	Structural and semantic similarity between two events/states/objects
Narration	Spatio-temporal consequence and shared topic among two events/states/objects
Result	Spatio-temporal consequence between two events/states/objects; cause

The description in the right column provides information about the conditions that should apply to the specific context in which the relation is identified. In the example analysis above, some of these conditions are paraphrased in very similar ways. What is not described further in this table is the definition of the units themselves, here given as either 'events', 'states', or 'objects'. Depending on the specific focus of the analysis (for example the discursive structure of several pages in a comic book, the relation between panels on a single comic page, or the interplay of even smaller

elements within individual panels), these units are not fixed beforehand, but need to be identified dynamically and on the basis of further inferential work.[2]

Comparing the different approaches and their definitions, the description given here is intended to be as inclusive and as general as possible for various levels of discourse in comics and graphic novels – be they narrative, argumentative or instructional. The relations described represent highly general semantic principles and logical relationships that are commonly assumed in many contexts in our daily lives. For instance, it is common knowledge that several events, states or objects stand in a causal relationship and lead to certain effects (e.g. pushing someone usually leads to the other person falling or stumbling). When these events or actions are described or shown in a discourse, this cause-effect relationship is usually analyzed as a discourse relation labeled Result (or sometimes also Explanation), and a necessary condition for the inference of such a relation is that the discourse also includes a cause which explains the connection between the two events or objects. When things are put next to each other for comparison, the relationships inferred between these two things are usually showing a Contrast, a Similarity, or a Parallel. This is equally true for two segments in a discourse, be they verbal or visual.

The analysis of these relations in a discourse, thus, directly builds on common knowledge about how things relate to each other. For this, however, not all details of this knowledge and the underlying structures have to be explicit in the discourse. This becomes even clearer when looking at the multimodal character of comics and other discourses in which even more information than in most written formats is given only implicitly, and much of the basic semantic content has to be inferred from non-verbal entities. One example in the passage above is, that no explicit information is given to identify the visually depicted character, such that the drawing has to be recognized as representing the same character that has been shown before in the comic, and which is the speaker or narrator of a written text that uses the first-person pronoun 'I'. While general relationships between events in verbal discourse can often also be expressed by so-called logical connectors (for instance conjunctions such as 'because', 'although', etc.), (audio-) visual elements often do not include any direct, explicit indication of such a connection. The little tail or pointer usually represents a direct relation to the character speaking, but that the picture shows something that is also described in the captions has to be logically concluded. These conclusions and relationships can be made visible by multimodal discourse analytical tools, a fruitful endeavor to explain meaning-making processes.

3. Connecting ideas: Origins of discourse relations

Interestingly, in most accounts of discourse relations, the specific types of knowledge and their underlying structures as shortly explained above are not systematized any further. Whereas some approaches identify 'logical

relations' (see below for details), they do not discuss their theoretical background in logics and the accompanying principles of reasoning. Similarly, the semiotic aspects of the processes of inferential reasoning about the relations are often not explained comprehensively, although the "'system-internal' (i.e., logico-philosophical) organizations of such processes" (Bateman 2017: 21) build an important foundation for a fruitful connection to cognitive approaches to comprehension. In the following, therefore, the basic foundations of approaches to discourse relations in logic and semiotics will be discussed in further detail.

3.1 Discourse relations as logical relations

In an overview and classification of the various linguistic accounts of discourse relations, which are also often called 'coherence relations', Bateman and Rondhuis (1997: 3) state that it is "commonly assumed that one essential part of comprehending and creating discourse is the recognition of intended relations". Similarly to many other discussions in the field of linguistics and discourse analysis, the concept of 'discourse' is no further explained nor is there any elaboration of what Bateman and Rondhuis see as a 'common assumption' about the comprehension of discourses. In most cases, the aspect of 'understanding' is given as a, if not the, strongest motivation, as it is directly mirrored in the description of discourse relations as "the cornerstone of comprehension" (Graesser et al. 2003: 82). However, the linguistic focus in most accounts is then often 'only' placed on the creation of coherence as a basic principle of texts and discourses.

In the realm of systemic-functional linguistics, for example, explicit connections between processes inherent to language and those of human thinking are generally rather scarce. One important exception is given in Halliday and Hasan's (1979) notable work on cohesion and, more particularly, on conjunction as a specific type of cohesive relation:

> There are certain elementary logical relations inherent in ordinary language; doubtless these derive ultimately from the categories of human experience, and they figure importantly on the sociolinguistic construction of reality, the process whereby a model of the universe is gradually built up over countless generations in the course of semiotic interaction. (They can be regarded as departures from the idealized norm represented by formal logic; but it is worth remembering that in the history of human thought the concepts of formal logic derive, however indirectly, from the logic of natural language.) These logical relations are embodied in linguistic structure, in the form of coordination, apposition, modification, etc. (Halliday and Hasan 1979: 320).

The authors, here, make explicit what is often seen as an obvious fact: discourse relations build on more general logical relations that again derive from processes of human experience. The short analysis in section 2 has broadly exemplified these general logical relationships. Their discussion

from a more systematic perspective, however, rarely receives a lot of attention. For instance, in Halliday and Hasan's work, neither are the 'categories of human experience' nor is the close connection to logics explained further – and the reference quoted above is in fact the only concrete mention of the notion of logic in the entire book.

In Rhetorical Structure Theory, the definition and recognition of relations between units "rests on functional and semantic judgments" and "illustrate[s] a diverse range of textual effects", such as "interpersonal or social effects, ideational or argumentation effects, and textual or presentation effects" (Mann and Thompson 1988: 250). The semantic judgments listed are nowhere explained. An important detail in this theoretical conceptualization of relations, however, is the requirement that the definitions apply "only if it is plausible to the analyst that the writer wanted to use the spanned portion of the text to achieve the Effect" (Mann and Thompson 1988: 258).

In contrast, a much more explicit connection between discourse relations and underlying logical principles is usually given in approaches in formal discourse analysis which aim at describing coherence from the broader perspective of a formal model of comprehension within a theory of communication. Logical concepts are then used to explain the activities involved in comprehension in terms of drawing inferences. Hobbs (1979, 1983), for example, in his important early works on 'coherence relations', states that

> the sense we have that a discourse is 'about' some entity or set of entities is frequently just the conscious trace of the deeper processes of coherence [which is] the mortar with which extended discourse is constructed (Hobbs 1979: 68–69).

These deeper processes of coherence are then usually described as principles of inferential reasoning and are thus also connected to processes of understanding or comprehension:

> Comprehension is not simply a matter of the Speaker depositing a proposition in the Listener's heard. It involves an active inference process, in which, among other things, the Listener must infer the specific from the general or the general from the specific, in order to zero in on the Speaker's full intended meaning. By choosing or ordering his utterances in a particular fashion, the Speaker can exercise some control over this inference process by supplying or modifying the appropriate framework for their interpretation (Hobbs 2004: 14).[3]

Hobbs himself and several other accounts in the context of formal discourse semantics give overviews of some of the most general inferential principles within the context of nonmonotonic logic, which is seen as driving commonsense knowledge:

> Virtually all commonsense knowledge beyond mathematics is uncertain or defeasible. Whatever general principles we have are usually only true most of the time or true with high probability or true unless we discover evidence to the contrary. It

> is almost always possible that we may have to change what we believed to be the truth value of a statement upon gaining more information. Almost all commonsense knowledge should be tagged with 'insofar as I have been able to determine with my limited access to the facts and my limited resources for reasoning'. The logic of commonsense knowledge must be nonmonotonic (Hobbs 2004: 2–3).

One specific variety of this nonmonotonic logic is abductive reasoning, which stands in the center of Hobbs's argument – and has later been taken up by many others, both in verbal discourse analysis as well as in semiotic accounts for media analyses (cf. Moriarty 1996; Jappy 2013). Hobbs himself bases his 'Interpretation as Abduction' framework on early works such as Newton's *Principia* (1934 [1686]), Christian Wolff's (1963 [1728]) understanding of philosophical hypotheses, as well as Peirce's explicit introduction of abduction as the third principle of reasoning (see more below). With this, it becomes an important starting point for several other works on discourse relations in the context of formal discourse semantics and artificial intelligence (see also Hartung and Cimiano 2007).

Asher and Lascarides (2003: 98), for example, criticize Hobbs's work insofar as his "abductive account misses important generalizations about the organization of different knowledge sources and their interactions during interpretation". In their work, the authors focus on exactly these knowledge sources and distinguish them in terms of several logics that are at work in a meaning-making process:

> One of our main claims here is that discourse interpretation should result from several interacting but separate logics rather than via a single, 'all singing all dancing' logic. Each logic is designed to do a distinct specific task: e.g., there is a logic in which you construct a representation of what is said, another logic in which you evaluate (the consequences of) that representation, a logic in which you reason about lexical polysemy, a logic in which you reason about another person's cognitive state on the evidence of his utterance and the assumption that he's rational and cooperative, and so on (Asher and Lascarides 2003: 430).

Much more so than other works published in this context, Asher and Lascarides make it evident that different knowledge sources as well as contextual conditions are at play when meaning is made in a (verbal) discourse interpretation. While the authors do not identify how this world knowledge results in the rhetorical relations they provide in their account, they still give a general architecture of these various logics in which they not only include the broad aspect of 'world knowledge', but also the aspect of the representation of such knowledge by another logic, the 'logic of information content' (see Asher and Lascarides 2003: Chapter 4). This part of their framework, in which formal representations are used to systematically identify the semantics, i.e. the meaning of the discourse, has its origins in the beginnings of formal logic and the general aim of representing knowledge and making beliefs, desires, etc. computable, i.e. processable.

Hans Kamp and Uwe Reyle's Discourse Representation Theory (DRT), a direct precursor on which Asher and Lascarides build their theory (SDRT), explains the idea of approaching meaning from a formal logical perspective with the following general remarks:

> One of the central features of cognitively complex beings like ourselves is that they reason. They move, with greater or lesser confidence, from beliefs they hold, hypotheses they entertain, desires they harbour, and intentions they have, to new beliefs and new intentions, and in this way they arrive at new ways of seeing the world and are propelled into new ways of acting upon it (Kamp and Reyle 1993: 9).

The authors, here, describe reasoning as some form of movement from one idea to another, which is very similar to how Bateman describes discourses as being made up of discourse moves, i.e. similar connections between ideas and segments (see the quote in section 2 above). Kamp and Reyle insist that the general reasoning process can only be properly systematized when the ideas and premises are available in some sort of representation, or language:

> However, the processes of reasoning cannot be understood [...] unless we assume that both beliefs, desires, etc. which act as the premises of mental inferences and the conclusions that are drawn from them have some kind of formal, language-like, representation structure within which the particular inference drawn instantiates a general formal inferential pattern, defined in terms of the structural relations between premises and conclusions as they appear within that mode of representation (Kamp and Reyle 1993: 9).

With this, Kamp and Reyle not only explain the strong connection between semantics as a theory of meaning and logic as the science of inference, but they also conceptualize the basic processes of reasoning as connecting new and old ideas. This is an important aspect of explaining the processes that lie behind the idea of discourse relations.

Kamp and Reyle give a few more details of the origins of formal logic and its connection to semantics when they refer back to Aristotle's syllogistic logic, in which classes of argument patterns are explained. They briefly talk about the further development into predicate logic as introduced by Frege (1980) and the general logical and semiotic processes as introduced in Peirce's work – and end up summarizing:

> Inference and deduction are activities in which human beings engaged long before logical theory began and which they engage in irrespective of whether the theory of logic is known to them or not. Logical theory must explain the nature of this activity (and, where possible, but only via this explanation, provide canons which might help us to improve it) (Kamp and Reyle 1993: 21).

With this plea for the close connection between reasoning in general and language and, more particularly, logic as a way of explaining processes of

reasoning, they then develop a model for the structural interpretation of sentences and texts (see also Wildfeuer 2014). The latter is in fact the intrinsic aim of all discourse analytical accounts, as has become apparent in the overview so far: theories of discourse comprehension usually describe links between language utterances (or discourses) and the world, but they also, and more importantly so, say something about how these links and discourses can and should be understood and interpreted (see also Kamp and Reyle 1993: 13). As a consequence, discourse relations as they appear in these theories may be seen as indications of how the link between discourse and world, between something communicated and something thought, can be described (and understood).

3.2 Discourse relations as 'signs' of knowledge

In the preceding section, some of the philosophical and semiotic origins to which discourse analytical approaches often recur have already been mentioned. While the earliest systematic thoughts reach as far back as Aristotle's conceptualization of logic, Peirce's foundational ideas about logic and semiotics play a similarly important role. In this section, I will discuss these in greater detail.

Interestingly, Peirce's more general ideas for a theory of communication are rarely taken into consideration within works that try to compute discourse relations more formally. As indicated above, abduction as a reasoning process plays an important role in these theories, and is indeed traced back to Peirce's conceptualization as a third principle of inference. However, no closer connections between this conceptualization and more general ideas in logic and semiotics are usually made. Nevertheless, Peirce's general thinking about knowledge, reasoning and the association of ideas are of particular interest and importance for the discussion here.

For instance, Peirce's conceptualization of logic as a general "science of the forms of thought" is already manifest in his early writings from 1860 (Peirce 1865: MS 921), which, according to Emily Michael (1978), is separated from psychology by its metaphysical approach:

> The study of how we think is the domain of psychology, according to Peirce. Logic, on the other hand, does not use our psychological processes as its data; it is unconcerned with our processes of thinking. The subject matter of logic, we are told, is: (1) 'logical reactions' of conceptions and (2) 'the thoughts as they present themselves in their logical form' (Michael 1978: 177; quotes from MS 921, published in Peirce 1865).

This distinction between logic and psychology as two different branches dealing with thoughts, one conceptually and formally and the other cognitively, is an important foundation for the understanding of discourse relations as specific logical relations that describe meanings and ideas in com-

municative artifacts. It is also an important basis for the differentiation between several types of comic theory to which we will come back in the conclusion of this paper.

Michael (1978: 179) states that "the findings of a science of logic will apply to all thoughts, but need not start with a study of thought." And the author further elaborates that

> we make the assumption that 'meaning resides in words and other material representations though these representations be understood or not, and whether they be actually written or fashioned or not' (Michael 1978: 179; quotes from Peirce 1865: MS 726).

By describing this understanding of logic as descriptive (and not normative), Michael then builds the bridge to logic as a semiotic study of

> the laws of linguistic symbols in terms of their necessary relations, quite independently of their derivation from or application to the mind (Michael 1978: 181).

Building on Peirce's general conviction that thinking always happens in signs, she concludes:

> That is, the logical relations of symbols in valid arguments are also descriptive of thoughts when thoughts are viewed as symbols and considered in terms of their logical relations (their logical form) (Michael 1978: 182).

This is in line with Peirce's later consideration of logic as a general 'semeiotic' (see Bellucci 2014) that sees the fundamental relation between premise and conclusion, and the process of reasoning along with it, as signs.[4] The important aspect here is that 'sign' must be understood as what Peirce sees as an 'external sign', an expression or instantiation, which Bellucci (2014: 525), in reference to Peirce (1893–1913: 544), calls "a sign materialiter":

> Materialiter, a piece of reasoning may be studied as instantiated in someone's thinking or as expressed through external signs (words, symbols, diagrams, etc.) (Bellucci 2014: 525).

Although Bellucci highlights that to avoid conflating this with psychology and cognitive aspects of reasoning (see above), the study of reasoning should concentrate on external signs and not on other instantiations of thinking, this general conceptualization of reasoning as a sign is another crucial point for our understanding of discourse relations – and it is very similar to what has been pointed out in formal-logical approaches to discourse as the need for a representation of the processes of reasoning (see section 3.1).

From a semiotic point of view, processes of reasoning and the resulting logical relations are seen as descriptions or representations of thoughts. This can then also apply to discourse relations as a specific type of logical

relations (see section 2.1), namely those instantiations of thoughts or thinking that implicitly connect external signs with each other (in a discourse). Due to Peirce's universal understanding of signs as not only verbal but also other material types of signs, it is then also reasonable to talk about those external signs and the instantiations of thoughts in multimodal and/or non-verbal discourses.

Although there is no concrete discussion of a similar notion of discourse in Peirce's work, his concept of a 'universe of discourse' (Peirce and Ladd-Franklin 1902) is closely related to the points made here. As Hugh Joswick (1996: 99) explains, this 'universe of discourse' is a

> common stock of knowledge between the utterer and interpreter that makes communication possible. It is not something that can be adequately described: it can only be indicated as something familiar to both speaker and auditor (Joswick 1996: 99).

The author further quotes from Peirce's own words:

> The parties of semiosis must thoroughly understand that they are talking about 'objects of a collection with which both have some familiarity … A certain amount of truth about this universe is taken for granted between them. So far as they have the same idea of the universe, upon that universe the attention of both is fixed; and when makes any assertion to the other, and the other assents to it, what happens is simply that their common idea of the universe becomes more definite; for their whole discourse is about that and nothing else' (Peirce 1976: NEM 3: 407; Joswick 1996: 99).

In an application of these principles, discourse relations in the semiotic understanding discussed above might be thought of as instantiations of thoughts in a common discourse on the basis of shared knowledge between the producer and the recipient. A discourse can therefore only be communicative and effective if both producer and recipient have a similar understanding of how the segments of the discourse relate to each other – and this understanding is based on a shared knowledge. Or, as Hobbs puts it:

> [C]oherence relations are conventionalized ways of being reminded of things. They are those ways of traveling through our mental maps that we can reasonably expect a listener to follow (Hobbs 1983: 10).

Making these discourse relations explicit in a discourse analysis is then also a process of making this shared knowledge explicit – though not comparable to the explicitness that cognitive experiments can bring about. Although the concept of discourse relations is often used to explain the meaning-making, inferential reasoning processes that recipients undertake to understand the discourse, the resulting descriptions of this analysis do not explain the brain processes that cognitive approaches aim at revealing. Instead, a logical and semiotic analysis of the discourse relations provides insight into the system-internal, i.e. the media specific, logico-philosophi-

cal organizations of such processes (see also Bateman 2017). How these system-internal organizations work on several different levels of comics and graphic novels, and how the set of discourse relations provided in section 2 can straightforwardly be implemented to show these organizations at work, will be demonstrated in the following section.

4. Discourse relations in use

In our previous work, we have already demonstrated the applicability of a small set of discourse relations to several levels of comics and graphic novels. We have shown that they can be identified to hold between relatively small units within a panel, such as, for example, between motion lines and the visual representation of a character (see Bateman and Wildfeuer 2014a: 189–194) or between so-called 'upfixes' and the head of a character (see Bateman and Wildfeuer 2014b: 381–383). We have demonstrated that they similarly hold between individual panels in a sequence, both within smaller comic strips as well as on larger pages from a comic or graphic novel (see also Wildfeuer 2014). For this, we have also discussed controversial examples from Cohn's approach to the analysis of narrative visual structures (e.g., Bateman and Wildfeuer 2014a: 196–199). Not least, we have shown that discourse relations have the potential to indicate spatial resources and layout strategies in large scale panel organizations (Bateman and Wildfeuer 2014a: 200–203; Bateman and Wildfeuer 2014b: 398; Bateman et al. 2017: Chapter 13; Wildfeuer 2021).

Almost all of the examples we have discussed so far are mainly from fictional genres and we have argued that an analysis of the discourse relations "helps to identify and describe the overall narrative structure of comics pages or more complex sequences of images" (Bateman and Wildfeuer 2014a: 196). With the following example, I want to argue that the basic set of relations provided is also applicable to other comic genres which are not primarily fictional or narrative, but particularly those that follow an educational and instructive purpose and for which the analysis of discourse relations helps to outline the particular teaching and instructive aspects of the comic.[5]

The analytical example in question is the so-called 'comic education module' examined in a study by Hanson et al. (2017) which tested the comic's fitness for educational use in a US hospital, where young patients complaining of pain were instructed on the application of pain medication at home. A survey of children and caregivers was conducted to find whether the comic influenced children's behavior at home. This education module consists of a comic spread featuring two pages with somewhat regular table grids, designed in black and white and with a relatively high proportion of speech bubbles spread over the various panels (see Fig. 2). According to Hanson et al. (2017), the predefined teaching goals included encouraging young patients to talk about their pain at home and to accept it as something normal after an injury, which can be treated with pain medication.

To support these teaching points, the authors created a simple story normalizing pain after injury, modeling a child asking for pain medication, and showing pain relief after medication. The teaching points are reinforced by two of the characters, and the comic includes a teach-back portion that prompts the reader to fill in a speech bubbles of a learning each of the three teaching points (Hanson et al. 2017: 530).

The authors explicitly highlight the comics' potential to "communicate more than just information, because the medium can visualize the fear and anxieties that patients may also feel" (Hanson et al. 2017: 529). In the comic, this visualization becomes clear in the facial expressions of the characters that are prominently displayed in almost all panels of the comic. They do not only show the injured kid's discomfort in general, but lend a visual appearance to their pain.

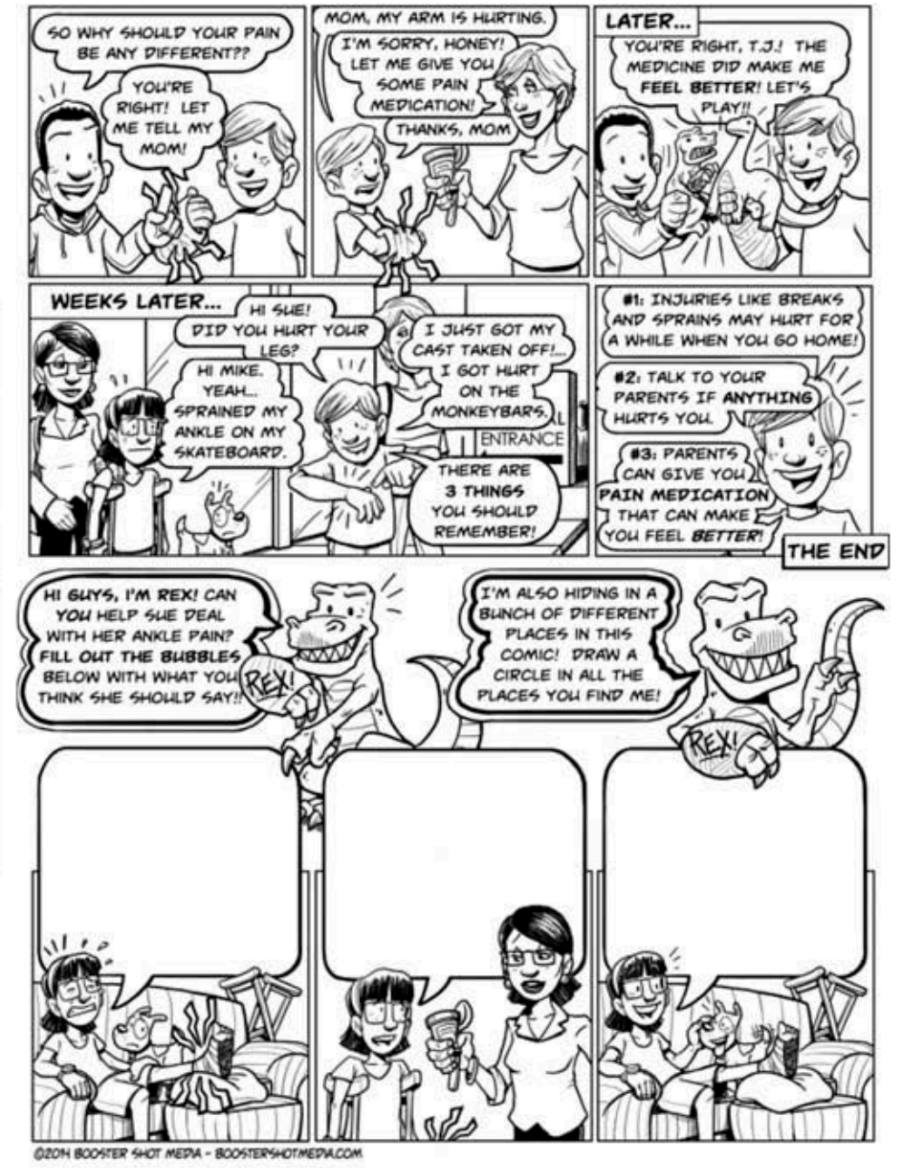

Fig. 2. Comic education module as used in the study by Hanson et al. (2017: 530).

This becomes very clear in the second panel in line 3 on the first page (see Fig. 2), in which the character on the left, T.J., asks the other character, Mike, whether their arm is hurting, and they reply: 'Yeah'. The logical connection between the pain that is mentioned by T.J. and the facial expression drawn for Mike can be made explicit by analyzing the discourse relation Enhancement/Elaboration between the units in this panel: The small visual details of the facial expression that is showing a sad, unwell kid specifies the verbally expressed 'hurting' even more.

Interestingly, Hanson et al. (2017) do not take into consideration any of the larger structural techniques of constructing the comic's story or the layout of the two pages on the spread. But they play as much of a role for the enhancement of the patients' understanding. This may similarly be made explicit by constructing the overall discourse structure of the comic by analyzing the discourse relations between the panels and larger units. For this, the spread and the overall unfolding story can first be divided into 4 different parts:

1. the first line of the first page constitutes the general description of the situation resulting from an injury, alongside the educational takeaway of three things that one should remember before going home – this is embedded in a conversation and can thus be seen as part of the overall narrative in which several characters experience some events in a specific setting;
2. the second part of the first page as well as the first line of the right page show a setting at home ("a few days later", as the caption says), wherein the two characters play together, eat, and find a solution for the kid's pain;
3. the second line on the second page shows yet another setting ("weeks later…"), in which the injured kid is now teaching the same three things to another friend who is also injured;
4. the bottom part of the second page is the "teach-back portion" (Hanson et al. 2017: 530) that lets the reader fill in speech bubbles to use the gained knowledge immediately for yet another narrative setting with two characters.

All four larger parts can be connected by discourse relations of the Narration kind, because temporal and spatial sequences between the events that are shown and told become clear in the captions or the setting in the panels. In addition, all four parts share the same topic. Even the final teach-back portion is embedded in one part of the story, since the two characters displayed there, Sue and her mother, are introduced earlier as experiencing a situation that is very similar to the one Mike and T.J. experienced before. The construction of such an overall narrative helps guide readers through the whole page, and the results of Hanson et al.'s survey confirmed that the comic was experienced as "likable, easy to read, and providing important information" (Hanson et al. 2017: 531). Hence, the instructive

genre of the comic as a whole uses a narrative story as its organizational strategy for the combination of both storytelling and educating elements (see Bateman et al. 2017: 314–315). It is exactly here that the potential of a broad discourse relations analysis comes to the fore: The relatively neutral approach to diverse forms of discourse with a very general set of relations makes it possible to describe the different genre patterns and elements simultaneously. This not only makes the complexity of the comics' discourse structure visible but also provides guidance for the interpretation of these specific patterns.

While the individual parts of the overall narrative structure are also mainly constructed by Narration relations holding between the panels, zooming in on individual parts shows what can further be revealed through such an analysis of relations, in this case holding between smaller elements, namely between and within the panels or dialogue parts in several panels. For example, in part 2 of the overall story, a Result relation can be inferred as holding between the event of asking the mom for a snack (in the right panel in the second row on the second page) and the event of bringing the snack in the next panel (on the left of the third row). This causal relation is exactly what is taken up in the dialogue to show the logical coherence between a cause and an effect in the two panels in the bottom row on the left page: "Think about it, Mike! What did you do when you were hungry? – I told my mom… – And what did she do? – She brought us a snack… – And are you still hungry? – Hmm… no!" Instead of actually explaining that there is a cause-effect relationship between hunger and eating a snack, the next panel then only points to the fact: "So why should your pain be any different?"

A very similar relation can also be inferred in the next panel (second in the top row on the second page) between the event of telling the mom that the arm is hurting and receiving some pain medication. Interestingly, these two events are, here, displayed in the same panel (and not in two subsequent panels), but the drawings are very similar to the ones used in the panel on the first page (and in fact, the event of expressing hunger is repeated in the panel on the left page). There is thus also a discourse relation holding between these two panels (one on the left and the other on the right page), which can be identified as a very strong Parallel, because both panels show a strong semantic as well as structural similarity. In the fourth part, in the "teach-back portion", this visual design of the specific panel is repeated again (in the middle panel in the last row on the right page) in order to create the same cause-effect relationship for the reader.

This kind of analysis demonstrates nicely how the actual cause-effect relation between having pain, getting pain medication, and feeling better (as is then also shown in the panel in the top right corner on the right page) is made clear for readers in several parts of the comic. The verbal text alone does not make this relationship explicit; it does not, for instance, outright state that pain medication works similar to food in that it somehow fulfills a specific need. Instead, it only implicitly shows this analogy by having a snack brought in when someone is hungry (which in fact establishes yet another

parallel) and having another character ask the question: "Why should your pain be any different?" The analytical identification of causal discourse relations between those panels can more strongly support this interpretation and further explain the reasoning processes. The relations here work as descriptions and representations of thoughts: As signs of knowledge (see section 3.2) that are activated by the rather implicit argumentation in the comic. The analysis can also hypothetically identify the discursive structure in which the Result and Parallel relations are embedded as having an educational purpose and, in comparison to the structures that evolve from Narration relations, not a purely narrative nature. This identification is in fact still hypothetical because an empirical analysis of a larger corpus of such structures would have to verify this particular pattern. The analysis as demonstrated here provides the methodological basis for this empirical verification.

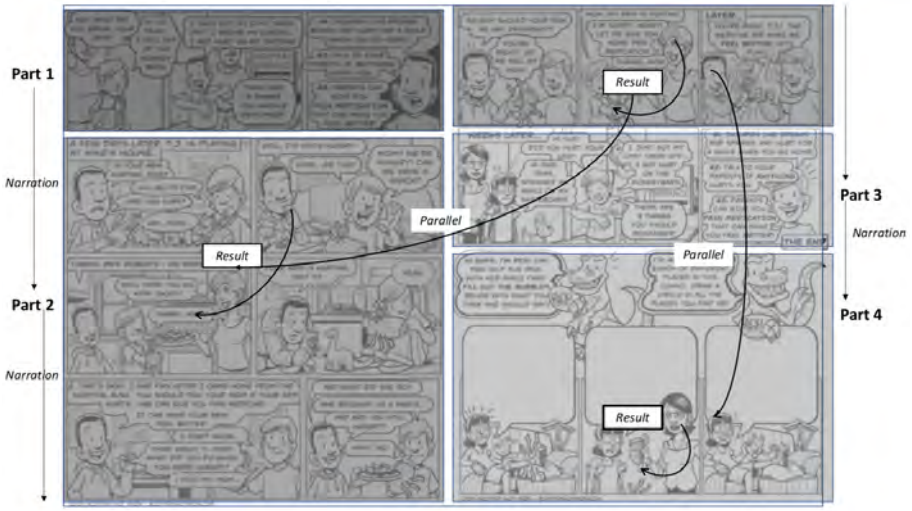

Fig. 3. Graphical illustration of the discourse relations in the comic spread used in Hanson et al. (2017: 530).

Figure 3 represents a graphical illustration of the relations holding between the different units and panels in this comic spread, and figure 4 gives a more abstract representation of the resulting discourse structure of the spread with the various relations between the different parts identified before. As described in section 3, outlining these various discourse relations showcases how they render instantiations of thoughts explicit, on the basis of certain knowledge. In this particular case, it is mainly the cause-effect relationships between several events and processes in the comic that not only show inferable links between specific entities of the discourse alongside corresponding entities in the world, but also explain how these links are meant to be understood and explained to others. An examination of these discourse relations then enumerates the basic processes of reasoning that

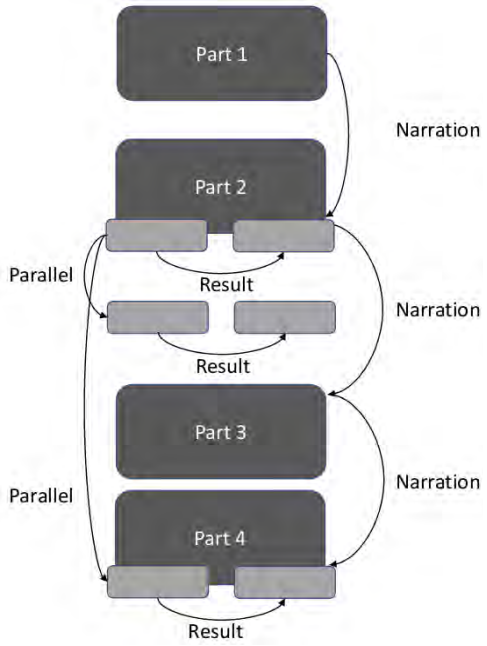

Fig. 4. Abstract representation of the resulting discourse structure of the comic spread.

are expected to happen when children and their caregivers read this comic – and Hanson et al. (2017) indirectly report on these processes when they summarize the results of their study (see also above). Their conclusion highlights that "patients need structured content, presented verbally, with written and visual cues to enhance recall", but provides no further details about this 'structured content' (Hanson et al. 2017: 531). The analysis of the discourse relations involved in constructing such structured content can therefore be seen as an important addition to the overall point that "[c]omic instructions are an innovative medium of communication that can be used to achieve these goals" (Hanson et al. 2017: 531).[6]

5. Conclusion

Understanding how comics work and how readers make meaning out of visual and verbal units has always been a central aim in comics studies. One way of approaching these processes of comprehension theoretically is the analysis of discourse relations between comics units, and this paper gives a broadly oriented overview of this kind of analysis on the basis of previous work in the context of multimodality research. As a result from this previous work, a concise set of discourse relations has been presented. By setting out these relations as logical relations and as signs of knowledge, the discussion has provided ways of making thoughts and knowledge structures for the construction and design of comics explicit. A short example analysis of discourse relations in an educational comic has demonstrated the applicability of this set to a specific comic genre. Similar to some of the previous work, the paper first of all showcases yet another case of building analytical hypotheses for the understanding of comics on the basis of semiotic and discourse analysis.

Hence, this account is clearly to be distinguished from cognitively oriented approaches in the realm of psychology and neuroscience. Many other approaches have similarly addressed and are still pushing a theoretical-meth-

odological account to meaning-making in comics, and our own account also strongly connects to advancements in cognitive psychology and the study of discourse comprehension (such as Asher and Lascarides 2003; Kamp and Reyle 1993). Nonetheless, criticism has continuously been raised against this type of research, particularly with regard to the lack of "adequate evidence" and the need to "be verifiable through some sort of testing" (Cohn 2014: 57, 68). This is understandable insofar as empirical work on comics through psychological experimentation providing such evidence presents an important enrichment for the discipline of comics studies. However, theoretical advancements as well as consolidation and combination of existing theoretical approaches are similarly needed in this dynamically evolving field, which is often challenged by transdisciplinary discussions and sometimes loses sight of important theoretical foundations.

Consequently, the approach presented in this paper contributes to the aim of building a 'better comic theory' (cf. Cohn 2014) by providing arguments for and explanations of the "necessary 'system-internal' (logico-philosophical) organizations of […] processes of signification" (Bateman 2017: 21) by delivering starting points for the empirical analysis of the brain processes following up on, or activated by, these signification processes. As Bateman further points out, "establishing connections between these levels of description constitutes a challenging and worthwhile research task of its own" (Bateman 2017: 21), and, as explained in the introduction, the discussion in this paper explicitly aims at contributing such a connection. Moreover, and with particular regard to the development of multimodal methods for the analysis of comics, the kind of theoretical foundation offered in this paper also serves the need for more qualitative, or discursive, accounts that complement the trend towards a stronger use of experimental methods in interdisciplinary environments (see the discussion in Bateman 2022 as one example).

Notes

1 There is for example a far-reaching consensus about the relation that indicates a spatio-temporal sequence, which is called Narration, but there are many different forms of Elaboration, e.g. expansion, enhancement, etc.

2 I thank the anonymous reviewer for their careful consideration of this analytical step. Parts of our previous work deal with this topic more substantially, see, e.g., Bateman and Wildfeuer 2014b and Wildfeuer 2019.

3 A further example of a very explicit connection to earlier philosophical works is given by Asr and Domberg (2012) in their introduction to a paper on the implicitness of discourse relations: "David Hume, in his prominent work 'An enquiry concerning human understanding' proposed that ideas in the human mind were associated according to at least three types of relations: resemblance, contiguity in time or place, and causality (Hume, 1784). Since then, many language scientists have tried to adapt this idea about human general reasoning to the world of language [...]" (Asr and Domberg 2012: 2670).

4 As part of his broader conceptualization of logics in general, Peirce also introduces (first in his work "Short Logic"; Peirce 1893–1913: 11) the notion of a 'speculative rhetoric' which he later defines as "the theory of advancements of knowledge of all kinds" (Peirce 1893–1913: 256) and which Rellstab (2008: 327) paraphrases as "an investigation of the human mind" in order to "know just what the processes are whereby an idea can be conveyed to a human mind and become embedded in its habits" (Peirce 1893–193: 330). A prerequisite for this process of understanding is a 'common ground', "a set of believes taken for granted as part of the background of conversation. Communication, then, can be seen as the re-constitution of this common ground" (Rellstab 2008 328).

5 Interestingly, many of these genres often additionally use a narrative structure when giving instructions or aiming at enhancing readers' understanding. We discuss this further in the use case chapter on comics and graphic novels in Bateman et al. (2017: Chapter 12) and also examine a meta-comic which still uses a narrative structure as its organizational strategy.

6 And subsequently, it is of course also of particular interest to test empirically whether the children and caregivers actually process this kind of reasoning – a question that should then be addressed by more experimental, user-oriented studies.

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Fig. 1. Emma (wri/art) (2017: 106).
Fig. 2. Hanson et al. (2017: 530).
Fig. 3. Hanson et al. (2017: 530).

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