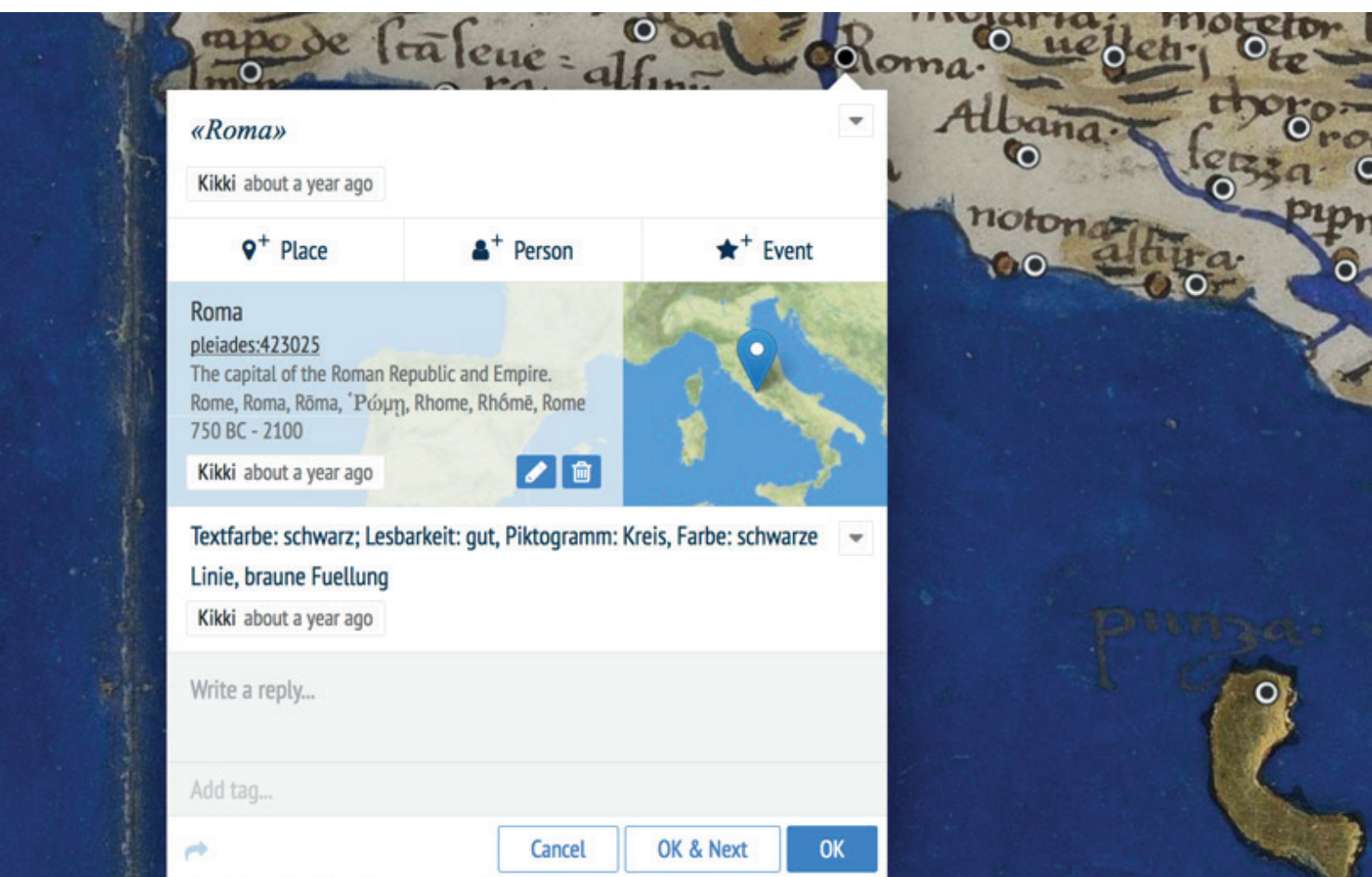


Walking Through History

An Interdisciplinary Approach to Flavio Biondo's Spaces in the "Italia illustrata"

Edited by Tanja Michalsky & Martin Thiering



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Outlining a Quantitative Analysis of Their Granularity
and Spatial Relationships

keywords – *Place descriptions, Hierarchical structures,*
Spatial relations, Spatial cognition



This chapter outlines a quantitative method for analyzing location descriptions. Generally, such a quantitative analysis allows for identifying pre-dominant features of these descriptions and, given a sufficiently large corpus, may allow for statistical inferences. Here, an English translation of Biondo's chapter on the region Latium is used as a small case study illustrating the method. The analyzed features include the frequency (distribution) of the level of granularity of those entities referred to in the descriptions, which spatial hierarchical structures emerge from referring to different entities on potentially different levels of granularity and the frequency of these structures, and which spatial relationships between entities dominate in the descriptions. The chapter presents results of this analysis and discusses them in detail, also pointing out limitations of the method. However, mainly the chapter is to be read as an introduction to this particular analysis approach, which may be used to complement other analyses and may offer insights not otherwise gained.

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The Description of Places in Biondo's *Italia Illustrata*: Outlining a Quantitative Analysis of Their Granularity and Spatial Relationships

Kai-Florian Richter

1. Introduction

Place descriptions¹ answer a 'where question' about a thing or event – they localize the thing or event in a larger space, such that the recipients of the description understand where it is relative to that larger space. Place descriptions are natural language expressions, in that they provide great flexibility in how they might be constructed, which to a large extent depends on the communication context. Generally, however, they take the following form to describe the location of some thing or event:

[[*(opt)* subject verb] *(opt)* preposition] NP²

Here, "NP" represents the noun phrase referring to a location (e.g., "Rome"). The location can be further specified using an (optional) preposition (e.g., "in Rome", "near Rome"), and might be (optionally) embedded in a complete sentence (e.g., "The Pantheon is in Rome" or "He lives near Rome").

The scale or granularity³ of the spatial entities referred to in such place descriptions can vary greatly, ranging from objects on table-top spaces (e.g., "the book is on the left of the desk"), to locating countries (e.g., "Italy is in Europe"). Independent of the level of granularity, these descriptions typically exhibit a hierarchical structure in their granularity, i.e., the different entities mentioned in the description differ in their respective level of granularity.⁴ Often, these structures can appear as zooming in (e.g., "in Rome, at the Colosseum") or as zooming out

(e.g., "at the Colosseum in Rome"); whereby they move from a location on a coarser granularity level ("Rome") to one on a finer level ("the Colosseum") or vice versa.⁵ These hierarchical structures reflect the hierarchical organization of spatial knowledge in our mind.⁶ They also capture the relationship between figure and ground, i.e., the fact that these descriptions are referring expressions that relate some foregrounded entity (the figure) as relative to another (the ground). (The former is typically seen to be more movable, smaller, geometrically simpler, more salient, and/or more recent than the latter).⁷ In other words, the ground entity acts as a reference object for the figure. In verbal communication, addressers usually choose reference objects of which they assume that their characteristics (e.g., name or location) are known to the recipients of the description and, thus, help to resolve ambiguity and uncertainty in locating the entity referred to.⁸

2. Aims

In a nutshell, the aim of this chapter is to illustrate an approach to analyzing location descriptions using quantitative measures. Such a quantitative analysis will allow for identifying predominant features of these descriptions and, given a sufficiently large corpus, may allow for statistical inferences. The analyzed features include the frequency (distribution) of the level of granularity of those entities referred to in the descriptions, which hierarchical structure appears most frequently, and which spatial

¹ Place is a somewhat elusive concept that does not just capture 'objective' geographic reality, for example, topography. It is often defined as encompassing three aspects, respectively termed locale (its shaping through human activity), sense of place (its character, its meaning to people), and location (where it is on the earth's surface);

see, for example, (Agnew 1987). In the present chapter, however, the focus is on the location aspect of place. Accordingly, we will mainly use location as a term in the remainder of this text.

² Richter/Winter et al. 2013.

³ In other contexts, also sometimes called "degree of specificity"; Cf. Svorou 1994;

Thiering 2015.

⁴ See Shanon 1979.

⁵ See Plumert/Spalding/Nichols-Whitehead 2001.

⁶ See Hirtle/Jonides 1985.

⁷ See Talmy 1983.

⁸ See Grice 1975.

relationships between entities dominate in the descriptions. Such quantitative data then in turn allows us to draw conclusions about stylistic preferences in describing locations. More interestingly, it also tells us something about the underlying spatial knowledge and conceptualization of space (the mental image) of those providing the descriptions, but also the assumed (background) knowledge and level of familiarity of the addressee.

The analysis approach will be demonstrated using a chapter of Biondo's *Italia Illustrata* as the sample corpus,⁹ but it can, in principle, be applied to any collection of verbal or textual location descriptions.¹⁰ The approach was originally developed for analyzing verbal descriptions collected through a location-based game that asked participants to respond to the prompt, "Tell me where you are."¹¹ Hence, using it on a different corpus may require some adaptations in practice, as explained in the Methods section below.

3. Methods

Generally, in performing the analysis outlined above, the corpus at hand is first divided into individual statements (expressions or parts of speech/text). These can be individual location descriptions if the corpus is a collection of descriptions made by multiple people, or individual sentences, or even parts of sentences if the corpus covers a text by a single author. In the next step, each statement is annotated with respect to levels of granularity, its hierarchical structure, and the spatial relationships between the entities mentioned. Counting these annotations results in some frequency distributions for each of the aspects, which can then be further analyzed.

For the case study presented here, an English translation of a chapter of Biondo's *Italia Illustrata*¹² was chosen to illustrate this kind of analysis. Biondo's chapter describes the region of Latium – the region Rome is located in. As stated above, the analysis is executed on the basis of individual units, i.e., statement by statement. Therefore, the text needs to be

split into these statements first, which requires a mix of automated and manual processing of the document.¹³ It is important to note that for the corpus at hand – Biondo's chapter – a statement is not the same as a sentence in a grammatical sense, but is rather a semantic unit (or construction) that forms a self-contained description. Accordingly, splitting the text is more elaborate than simply looking at each individual sentence, as is explained in the following.

The chosen chapter from Biondo's book contains 432 sentences overall, i.e., statements finished by a full stop. The full stop character (".") was used to automatically split the document into individual elements for further processing. From here, all following steps in the analysis were performed 'manually', i.e., via manual annotations and coding done by the researcher. This was deemed necessary as these steps require semantic decisions that are difficult to automatize – without however excluding the fact that automatization would, in principle, be possible for some of these steps (see the discussion below).

In a initial run-through of the separated sentences, it was first decided whether each sentence contained (elements of) a place description at all. This first run-through eliminated 201 sentences, leaving 231 for analysis. However, several of these 231 sentences *de facto* combine several statements conjoined by conjunctions, such as "and" or "although", or punctuation marks, such as a colon (":") or semicolon (";"). Accordingly, these sentences were in turn split into their respective sub-statements, resulting in a final sum of 271 statements culled for analysis.¹⁴

Next, in the annotation step every statement was categorized according to whether it was a 'proper place description' or rather designation, described some movement of people (individuals or groups), animals, or objects through space, or described an event located at some place. A proper place description describes a geographic location in the strict sense of 'place description' as explained in the introduction. Examples of

⁹ Biondo 2005b; Biondo 2016.

¹⁰ In fact, the approach seems to be applicable to both synchronic and diachronic data.

¹¹ Winter et al. 2011, Richter/Winter et al.

2013, Richter/Vasardani et al. 2013.

¹² Biondo 2005b, pp. 118–202, see also Biondo 2005a and Biondo 2010.

¹³ Götz et al. 2018.

¹⁴ Note that not every appearance of

a conjunctive term or punctuation mark requires splitting a sentence. Often "and" is used as part of an enumeration, for example. Therefore, a naive automatic splitting using these terms and marks would not guarantee

such proper place descriptions or designations are sentences 28 and 170 of the Biondo chapter:

28: There was in the forum of the Antiates a temple of Castor and Pollux, whom they called their Saviours according to Strabo.

170: Above the town of Traiectum, three miles from the sea, beside the Liris, is the castle of Speninum.

The former locates a temple with respect to a forum, the latter locates the castle of Speninum with respect to the town of Traiectum, the sea, and the (river) Liris.

Some statements rather describe a trajectory, i.e., a physical or virtual motion event, of somebody or something moving through space, describing that space along the way. An example of such a 'movement statement' is sentence 110:

Four cohorts were dispatched with C. Servilius Ahala by a circuitous route, and, having captured the hill overhanging the city, from their higher position where there was no defence, they invaded the walls with an enormous noise and shouting.

While these statements contain elements of place descriptions, for example, locating the hill with respect to the city, they do so 'implicitly' and in passing, i.e., at least from the outset their main aim is to describe some motion event.

Other statements describe (historical) events that happened at specific locations, thereby introducing or describing these locations. Again, these contain elements of place descriptions as defined above, but the purpose seems rather to provide some historical context for these locations. An example of such a statement is sentence 140:

But although the gulf of Caieta and the citadel were of great and ancient fame, it was not a city until the Saracens (as we have shown above) destroyed Formiae.

Following the annotation step, each statement was analyzed with respect to the granularity – or scale – of each geographic entity referenced in the statement, following the approach by

Richter *et al.*¹⁵ The different levels of granularity employed and some example entities for each level are listed in Table 1 below. The original classification scheme of granularity levels as developed by Richter *et al.* has been extended for the analysis presented here. In their work, Richter/Winter *et al.* 2013 and Richter/Vasardani *et al.* 2013 looked at location descriptions that would localize a person relative to their environment (they asked people to "Tell us where you are").¹⁶ As the geographic footprint of a person is rather small, differentiating geographic entities beyond city scale was not deemed relevant in their analysis. However, in the case of Biondo's description of Italy and its regions, it quickly turned out that towns and cities are the main geographic entities that are being localized. To account for this crucial difference, the original classification scheme was extended, introducing a finer differentiation on coarser levels of granularity, as is indicated in Table 1.

At the same time, hierarchical structures present in the descriptions were identified (e.g., 'zooming in', 'zooming out'). Following Richter/Vasardani *et al.*,¹⁷ a location description can exhibit the following hierarchical structures:

- Strictly hierarchical: a location description shows a behavior of strictly monotonically increasing or decreasing granularity levels. The sequence of levels is either zooming in or zooming out. There are no duplicates on the same level of granularity.
- Partially hierarchical: a location description shows a monotonically increasing or decreasing behavior. Duplicates on the same level occur.
- Flat: all entities referred to in a location description are on the same level of granularity.
- Unordered: non-monotonic location descriptions, i.e., the description shows first (partial) zooming in and then (partial) zooming out behavior or vice versa.

Further, for the proper place descriptions, an analysis of the spatial relationships between the geographic entities mentioned in a statement was performed, using the categories detailed

results in a meaningful set of statements.

¹⁵ Richter/Winter *et al.* 2013, Richter/Vasardani *et al.* 2013.

¹⁶ The descriptions were specifically collected for the purpose of that analysis; thus, Richter/Winter *et al.* 2013 and Richter/Vasardani *et al.*

2013, took a synchronic point of view.

¹⁷ Richter/Vasardani *et al.* 2013, pp. 343–344.

level of granularity	description
furniture	location within a room ("at my desk", "bed"), small vehicles ("bike"), or small natural features ("a stone")
room	location within a building, or within parts belonging to it, medium-sized vehicle
building	location of a building, large vehicles
street	streets within a town, larger than building and/or vaguer boundaries than building, includes infrastructure and public spaces, natural features of medium size
district	suburb, rural district, post-code areas
city	town or city, metropolitan areas
geographic feature	major roads between towns, single mountains
region	named parts of a country, mountain ranges
country	countries, seas, oceans

Table 1

The different levels of granularity employed in the analysis.

spatial relation	indicators (prepositions)
topology	along, in, on, outside, through, up ...
relative orientation	across, in front of, opposite, under ...
qualitative distance	by, close to, just off, near, next to ...
quantitative distance	t is <i>n</i> miles, <i>n</i> miles from ...
correspondence	by the name, was then, which is now, changed to ...

Table 2

Categories of spatial relationships used in the analysis.

in Table 2 and again following the approach by Richter *et al.*¹⁸ Most often, prepositions indicate the kind of spatial relationship that exists between two entities.¹⁹ Importantly, a statement can reflect several of these relationships at the same time as, for instance, a given entity can be localized using both qualitative and quantitative distances to other entities. For example, sentence 106 ("And Strabo reports that the land reclaimed from the marshes, from the Pontine Marshes to the territory of Terracina, stretched for a hundred stades, which our contemporaries calculate at eight miles") says that "the land" stretches between some marshes and a territory (qualitative distance), which covers a distance of a hundred stades (quantitative distance). In addition to the categories used by Richter *et al.* a further category – "correspondence" – is introduced to capture occurrences when Biondo links

historical (Roman or earlier) place names, which are no longer in use, to the (then)–current place name of an entity (e.g., sentence 11: "In order to follow the most knowledgeable author in antiquity and also Plinius [...], we are compelled to attach the region of the Latins to our present-day region Campania and Maritima").

Spatial relationships were not investigated for statements describing movement or events since, for one, their main purpose is not to localize entities with respect to each other as explained above, and, for another, an initial attempt at this analysis showed that many of these statements are not easily/unambiguously categorizable (if at all).²⁰ Once the annotation of the statements is finished, different quantitative indicators can be calculated, which are explained in the next section.

¹⁸ Richter/Winter *et al.* 2013.

¹⁹ The Latin text would use the locative, ablative, and allative case to encode spatial relations.

²⁰ For more, see Thiering/Berthele 2022 in this volume.

	furniture	room	building	street	district	city	geographic features	region	country
all	9 (1.53%)	11 (1.87%)	57 (9.68%)	26 (4.41%)	48 (8.15%)	212 (36.00%)	137 (23.26%)	74 (12.56%)	15 (2.55%)
proper place description	5 (1.15%)	8 (1.84%)	46 (10.55%)	12 (2.75%)	33 (7.57%)	152 (34.86%)	114 (26.15%)	57 (13.07%)	9 (2.06%)
movement	0 (0.00%)	0 (0.00%)	3 (4.92%)	9 (14.75%)	8 (13.12%)	22 (36.07%)	11 (18.03%)	7 (11.48%)	1 (1.64%)
event	4 (4.35%)	3 (3.26%)	8 (8.70%)	5 (5.44%)	7 (7.61%)	38 (41.30%)	12 (13.04%)	10 (10.87%)	5 (5.44%)

Table 3
Frequency distribution of the levels of granularity.

	flat	strict zoom in	partial zoom in	partial zoom out	strict zoom out	unordered	total
all	63	42	24	23	38	81	271
proper place description	40	29	16	19	30	61	195
movement	1	3	2	4	1	13	24
event	22	10	6	0	7	7	52

Table 4
Frequency distribution of the hierarchical structure present in the location descriptions.

4. Results

From the small corpus of 271 analyzed statements (constructions or collocations), 195 were categorized as a proper place description, 24 as movement statements, and 52 as events. In other words, the purpose of the majority of statements (72 percent) is to localize geographic entities, while a smaller part (8.9 percent and 19.1 percent, respectively) refer to (motion) events – with the caveat that 201 sentences (46.5 percent) of the chapter's overall sentences had been excluded from analysis in the initial step, i.e., did not contain (useful) spatial references at all.

Overall, the 271 statements mention 589 geographic entities, or just over two entities per statement on average. These entities are not necessarily unique, since several (consecutive) statements may refer to the same entity; or an entity might be mentioned more than once in a single statement, for that matter.²¹ It is interesting to note that while on average there are overall just over two entities mentioned in a statement ($m = 2.17$), for movement statements the average is slightly higher ($m = 2.54$), while for event statements it is on average less than two ($m = 1.77$).

Table 3 provides details on the levels of granularity these entities fall on, both overall and for the different types of statements. It can be observed that most references are made to entities on the city level (i.e., mentions of towns and cities), followed by entities on the geographic features level (e.g., rivers, major roads, or forests). Given the purpose of Biondo's text, namely describing the geography of Italy and its regions, this finding may not be surprising.

Table 4 lists which hierarchical structures are contained in the different statements. No clear image seems to emerge here, except that by looking at all statements, irrespective of their type, no clear hierarchical structure is observable. Descriptions are either 'flat' or 'unordered' (63 and 81 out of 271, respectively; or 23 percent and 30 percent of all descriptions respectively). The rest of the statements either (partially) zoom in or (partially) zoom out, with approximately equal distribution. The same holds true when only looking at proper place descriptions. A different image emerges when looking at movement and event statements respectively (albeit based on much smaller sample sizes): movement statements seem to be mostly 'unordered' (13

²¹ The uniqueness of entities, or their frequency of being mentioned, has not been further analyzed,

but may provide a further interesting aspect to look at in the future.

Table 5
Frequency distribution of the spatial relationships expressed in the proper place descriptions.

Description	Frequency
topology	102
relative orientation	86
qualitative distance	69
quantitative distance	36
correspondence	10

out of 24, or 54 percent), while event statements seem mostly ‘flat’ (22 out of 52, or 42 percent).

Finally, Table 5 shows the frequency distribution of the spatial relationships expressed in the analyzed statements. Again, this analysis was only performed for the proper place descriptions; it is worth remembering that there might be more than one spatial relationship expressed in a single statement. Indeed, 302 spatial relationships are observed in the 195 proper place descriptions, a third of which describe a topological relationship (e.g., sentence 28: “There was in the forum of the Antiates a temple of Castor and Pollux [...]”, or sentence 142: “Caieta has always had an excellent harbour on its bay [...]”). Often, Biondo also localizes entities by describing how they relate to other (possibly better known) entities in the surroundings. This may lead to rather elaborate descriptions, such as in sentence 85: “For it was separated from the mainland by swamps, which were cut off by the river flowing from the Mons Albinus [...]”, or in sentence 107: “Even now part of the Pontine Marsh lies next to Terracina, where the swamp is formed by two rivers, the larger of which is called Aufens and at Terracina the Via Appia first touches the Mare Inferum.”

5. Discussion

As already mentioned in the Methods section, the text’s main aim (at least on the surface) seems to be to localize towns and settlements within the region of Latium. References to entities on this level of granularity are most frequent, with over one third of all references made. Adding to this, those references made on the level of geographic feature account for more than half of all references made. The latter are relevant here because towns are often localized

relative to their surroundings, with, for example, towns being located along roads (e.g., sentence 144: “And the first city on the road is Fundana [...]”), or on a hill (e.g., sentence 194: “Five miles from here is the town of Somninum, set on a steep hill [...]”). Accordingly, there are only very few references to entities on the finest levels of granularity, namely furniture and room, since such entities are considerably smaller than towns. References on these levels only occur in parts of the text where Biondo digresses from a ‘true’ description of the region’s geography, or where they otherwise provide some relevant information. For example, sentence 180 (“Recently, in the town which is corruptly called ‘Civita Indivina’ and is owned by cardinal Prospero Columna, a stone inscribed in capital letters was found, which shows that that town is Lanuvium”) highlights the discovery of a stone (categorized on the furniture level), since that stone provides important evidence for its historic name (and Biondo’s justification for using it).

Looking at hierarchical structures expressed in the descriptions, it is notable that in most descriptions no clear structure is apparent. Many are either ‘flat’, often because they simply localize towns with respect to each other (e.g., sentence 285: “Then there are Cellae, Sculcula and Peretum, from where one can descend to Taliacotium”), or they are ‘unordered’, i.e., go back and forth between granularity levels – effectively zooming in and out again or vice versa (e.g., sentence 320: “On the right bank of the Aniensis – from this Lake Sublacum to the Vicus Varronis – one sees an aqueduct cut into the rock of the mountain[...])). The former can be interpreted as another indicator that Biondo’s focus is on the towns of the region. The latter seems mostly attributable to his writing style, which tends to use a lot of insertions

and diversions (e.g., sentence 321: “[...]in fact Tibur, in the place where there is the temple of Hercules, has a waterfall, which is created by the Anio, as it falls from a very high point into a deep valley passing from the woods next to the city itself, where it starts to be navigable”). These insertions break up an ordered hierarchical structure, arguably often without necessarily supporting a better understanding of the locations described in the statement. Indeed, these ‘disruptions’ to an orderly hierarchical structure still occurred even after sentences were divided into individual statements (i.e., self-contained descriptions), before the analysis.

Movement and event statements²² seem to fall at either end of this spectrum: more than half of all movement statements are unordered, while a good 40 percent of all event statements are flat.

In terms of spatial relationships (topology, orientation, distance, correspondence), results are largely as were to be expected. A third of them are topological relations, which might not be surprising given that Biondo’s aim is to localize entities, mostly towns, which are in a region or on a hill. But there are a number of quantitative distance relations (about ten percent of all relations), which is interesting to note in what is essentially a qualitative description such as this text provides.

Looking more closely at the chapter, the description of the region Latium can be seen as being divided into three parts: the coastline, the inland, and the region around Rome. The description of the coastline follows (more or less) a linear course from north to south. On the other hand, the inland region is described following the course of three main roads – the Via Appia, Via Latina, and Via Tibertina (sentence 176: “But we shall adopt another, which will meet our needs better and which cannot be applied to other regions of Italy: by proceeding along the three roads – Appia, Latina and Tibertina – which by different routes will lead to the river Liris and to Sinuessa and Caieta”). Both ways of structuring the description of the coast and inland lead to a linear progression. But using main roads as a structuring principle may

lend itself more naturally to using quantitative distances, since along these roads there were/are distance markers (milestones). However, looking at the data, no such differences can be found: for the coastline 17 out of 80 descriptions (21.25 percent) refer to quantitative distances; along the roads there are 19 out of 102 (18.63 percent). In fact, for none of the different types of spatial relationships are there any notable differences between the different parts of the chapter.

6. Caveats: Limitations of the Approach

The study presented in this chapter has several limitations. Some of them are specific to this particular case study, some apply rather to the general analytical approach.

First, the analysis has been performed on an English translation of the Latin original. No attempts have been made to cross-check it with the original text.²³ While this English translation was specifically produced with an eye to capturing spatial aspects and geographic entities and can thus be taken as true to the original in content and meaning, the exact spatial prepositions used and the exact order of spatial references in the statements nevertheless matter for the results of the quantitative analysis. Shifts in that order, which may be grammatically necessary in the translation (Latin, for example, uses a case system rather than prepositions to denote syntactical relationships) would lead to different hierarchical structures between the Latin original and English translation. It is difficult to judge whether and how often this may actually occur between the two texts.

Further, the analysis has only been performed by the present author of this article. In an analytical approach such as this, however, the annotations should be checked by someone other than the author. This is usually done by performing an interrater agreement test. Two or three ‘naive raters’ – persons unfamiliar with the particular text and research questions – are provided with instructions on how to annotate a given corpus (e.g., the Biondo chapter). After annotating (a sample of) the corpus, these ‘naive’ annotations

²² See the discussion of trajectories above.

²³ See however, Görz/Seidl/Thiering 2022,

Guckelsberger/Geus 2022 and Thiering/Berthele 2022 in this volume.

are analyzed. The extent to which they (dis)agree sheds light on the clarity and usefulness of the instructions, helps to identify difficult or ambiguous cases, and serves as a way of double-checking how consistently and correctly the annotations were in general – not only those of the naive raters, but also those of the ‘experts’ doing the actual analysis. Since the main purpose of this chapter is to introduce, motivate, and demonstrate this kind of cognitive-structural analysis to an audience probably largely unfamiliar with such quantitative approaches in the first place, such an interrater agreement analysis was not deemed crucial in this case, but would certainly be a topic for future research.

As a general limitation, the presented approach separates a text, or corpus more generally, into individual statements, which are then analyzed ‘out of context’, i.e., each statement is looked at individually without accounting for its embedding in the text. This has several consequences. Pronouns that may refer back to entities mentioned in a previous statement are ignored, i.e., there is no entity resolution, replacing a pronoun with what it refers to. Moreover, such a statement-by-statement analysis leads to a very literal reading of the text. As the statements are taken out of their local context, their content is taken at surface value for what it is; except in obvious cases, no interpretation is attempted of any metaphors or figures of speech. This can be seen as a general limitation of this kind of analysis. It may be furthermore worth noting that in this specific case, a number of

cited ancient sources were also disregarded for closer analysis.

Finally, as it currently stands, the presented approach to analyzing location descriptions requires substantial manual processing. This is necessary because, despite the decontextualization that ensues through a statement-by-statement analysis, there nevertheless remain many decisions that depend on the semantics and context within a single statement. Correctly handling these poses challenges to machine intelligence as it requires a ‘proper’ understanding of the text. Having said this, there are parts of the analysis that could indeed be better supported by (semi-)automatic processing, for example, splitting sentences at punctuation marks (“;”, “:”) and highlighting potential split points, i.e., conjunctions (e.g., “and”). Further, pre-annotations could be performed by automatically assigning spatial relations (e.g., topology or qualitative distance) whenever the relevant prepositions appear (see Table 2 above). A similar pre-annotation could even be performed for the different levels of granularity by matching entity names (e.g., names of towns, lakes, or regions) to relevant topographic data – so called gazetteers.²⁴ However, such matching will never be perfect due to ambiguity and other issues.²⁵ On the one hand, these steps would result in a significant part of the annotations being done automatically. On the other hand, all the automatic annotations would need to be carefully checked afterwards by the researchers to verify consistency and correctness. It remains to be seen which workflow is more productive.

²⁴ There are tools and frameworks available that may allow for some of these steps to be done as outlined here, for example, Recogito (URL: <https://recogito.pelagios.org>). See, for example, Görz/Seidl /Thiering 2022 in this

volume, who use the BRAT semi-automated annotation tool.

²⁵ Derungs/Purves 2013; Vasardani/Winter/Richter K.F. 2013.

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