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RESEARCH ARTICLE

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# Advancing New Testament interpretation through spatio-temporal analysis: Demonstrated by case studies

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## Abstract

This article explores, via three case studies, how spatio-temporal analysis can advance New Testament text interpretation. Acts 2, verse 9 to 11 is the text of study. Case study 1 applies network analysis to data representing the Roman road network constrained by parameters valid for ancient times. This analysis provided new information on the background of people attending a festival in Jerusalem. Case study 2 located geographical entities from the text in a cartographic visualization and provided supportive information to compare contemporary textual resources. For the disciplines of textual and conjectural criticism (case study 3), spatio-temporal analysis opens a new window to study what would be the most probable variant of the original text. The case study puts emendations that have been proposed over centuries in a 3D spatial context and provides in this way a sophisticated tool to relate different alternative variants of a specific text. From the case studies, it can be concluded that spatializing, visualizing, and spatially analyzing geographical concepts from the texts in Acts 2 contributes to the field of New Testament interpretation. Further work will elaborate on the findings.

## 1 | INTRODUCTION

Using insights from geography is not new to the discipline of biblical research. Many biblical atlases cover the geography of Palestine, Asia Minor, and Greece. In addition, the cartographic production of these atlases has nowadays been optimized by the introduction of GIS. However, until now the use of GIS in biblical research has often been limited to topography and physical geography. Recently, increasing awareness that many phenomena are inherently spatial has

caused a spatial turn in various disciplines (Warf & Arias, 2009). Accordingly, insights from spatial–temporal studies are increasingly being considered to advance the field of biblical studies beyond topography and physical geography.[1]

The aim of this article is to explore the potential of geospatial technologies (like spatio-temporal analysis) to advance the interpretation of biblical texts. To study this potential, three case studies are carried out focusing on a list of nations that are mentioned in the New Testament book of Acts. The factuality of the nations mentioned has been disputed in several biblical research publications. The aim of our study is to provide more insights for this dispute by using spatio-temporal analyses.

## 1.1 | Structure

The article starts in Section 2 with an overview of what other researchers have done. Section 3 describes both the problem and the methodology of our research. It first introduces the text of study for this research, Acts 2:9–11, and the ambiguities of current interpretations. It then describes the general methodology of our research. Section 4 describes the three case studies that we carried out for the text of study. First, geographical visualization and network analysis are applied to provide a better understanding of the geographical and social context of the attendees in Acts 2. Then, the article proceeds with an analysis of suggested geographical arrangements of the nations mentioned. Finally, a reconstruction of the original wording of the text is studied by means of spatial analysis. Each case study starts with a further explanation of the problem studied, it then explains how the problem is addressed with GIS tools and ends with the results of the case study. Section 5 presents conclusions and suggestions for future work.

## 2 | PREVIOUS RESEARCH

Several other researchers have studied the use of spatio-temporal technologies to obtain more insights into ancient biblical contexts. In cooperation with the Russian Biblical Society, Korobtsov (2002, 2003) utilized GIS technology for data capture and produced two wall maps covering the Mediterranean area and two maps covering Ancient Palestine. The Instytut Geodezji i Kartografii (2006a,b) researched the design and implementation of a spatial–temporal information system of events and historical sources underlying biblical texts and identified potential digital and paper resources. This project published a number of articles: Mościcka (2006) proposed a system to collect and process time-oriented information on geographical objects and events described in the Bible. Mościcka and Brzezińska (2007, 2008) focused essentially on data modeling, classification, input, and attributes of geographical features mentioned in biblical texts. Linsenbarth and Mościcka (2010) discussed the issue of toponymy in biblical text fragments and presented a database architecture. Linsenbarth also studied the implications of climatic and geopolitical conditions (2007) and orographic reference data (2008) for the lands of the Bible by GIS. Finally, Moshier and Hoffmeier (2014) employed satellite imagery to reconstruct ancient coastlines and river channels at the times of the Bible and used GIS routines to model surface hydrology. They suggest that this reconstruction could provide background to advance our understanding of the Exodus narrative.

All these studies are mainly limited to reconstructing the geography and topography of Biblical times (i.e. none of them studied the improved interpretation of Bible texts by the use of GIS, which is the topic of this article). Consequently, the applications of spatio-temporal analysis to a diversity of biblical texts are still limited in scope and complexity, and the endeavors are mainly grounded in human geography and especially in the field of critical spatial theory (Mayordomo, 2017; Schreiner, 2016; Stewart, 2012). Although these studies provided new insights, it is expected that more value could be gained when applying spatio temporal studies and technology to the domain of biblical studies.

Only Larsen and Benzek (2014, 2016, 2017) did similar research. They applied spatio temporal methods as hermeneutical[2] tools (i.e. tools for interpretation of Bible texts) in a classroom setting for undergraduate students. The research of this article extends the work of Larsen and Benzek and studies how spatio temporal techniques can help in the interpretation of New Testament texts.

## 3 | FURTHER EXPLANATION OF THE PROBLEM AND METHODOLOGY

This section provides a brief overview of the book of Acts to contextualize this study and further introduces the text from Acts 2 as the object of the case studies (Section 3.1). It also explains our methodology to collect the spatial concepts required for the case studies (Section 3.2).

### 3.1 | Interpretation problem of the text of study: Acts 2:9–11

The texts in Acts 2:9–11 are the object of our study. These verses are part of the New Testament book the Acts of the Apostles, which is the sequel to the Gospel of Luke. Whereas the Gospel of Luke narrates the story of Jesus with a specific focus on his public performance, crucifixion, and resurrection, Acts continues the story for some 30 years. Starting in Jerusalem on the day of Pentecost, the narrative tells "the progress of the gospel along the road leading from Judaea via Antioch to Rome" (Bruce, 1988, p. 8). It traces the expansion of the Jesus movement from Jerusalem, the geographical backwater of the Roman Empire to its capital Rome.

The first part of the book (1:1–15:35) has the apostle Peter as its main character and the inclusion of gentile Christians into an original Jewish sect as its main concern, while the second part (15:36–28:31) follows the apostle Paul on his missionary journeys. Owing to the disproportionate amount of space dedicated to Paul's defenses to Jewish and Roman officials in Acts 22, 24, and 26, it has been suggested that the author Luke uses this second part to provide an apology for Paul, cf. Keener (2012, pp. 223–224, 435–458).

The texts under scrutiny can be found in the introductory part of the narrative, which is situated in Jerusalem. They list nations attending the Jewish Pentecost—a religious festival occurring annually 50 days after Passover to celebrate the harvest of first fruits. The list of 15 geographical names used to specify the nations and peoples is grouped according to a chiastic pattern[3] of both "races and nations"[4] which "embrace a wide sweep of the eastern Mediterranean" (Dunn, 1986, p. 786):

> [9] Parthians and Medes and Elamites and residents of Mesopotamia, Judea and Cappadocia, Pontus and Asia, [10] Phrygia and Pamphylia, Egypt and the parts of Libya belonging to Cyrene, and visitors from Rome, [11] both Jews and proselytes, Cretans and Arabians—we hear them telling in our own tongues the mighty works of God. (Acts 2:9–11, ESV)
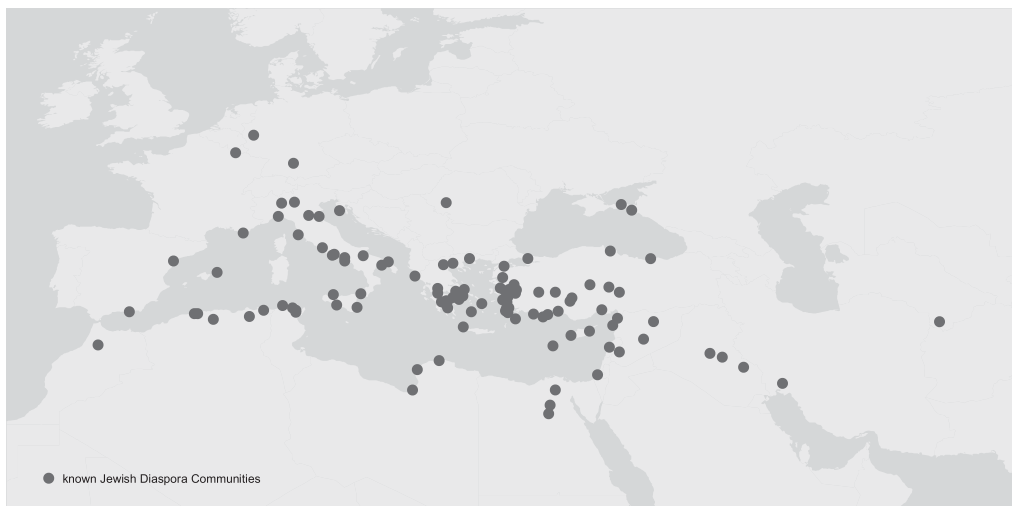


● known Jewish Diaspora Communities

FIGURE 1    Known Jewish diaspora communities

In general, it is assumed that the listed nations resemble the Jewish population as spread throughout the ancient world.[5] Ancient authors, like the Greek geographer Strabo (cf. Josephus, Ant. 14.114–8), the Jewish historian Josephus, and the Alexandrian philosopher Philo (Embassy 281–2), indicate the widespread dispersion of the Jewish people in the first century AD. Figure 1 gives a general impression of known diaspora communities (i.e. the geographical dispersion of the Jewish population).

Popular Bible atlases [e.g. Currid and Barrett (2010, maps 12–13) and Beitzel (1985, map 85)] provide maps locating the peoples and nations of Acts 2, but conceal the text's "frequently problematic geography" (Sleeman, 2013, p. 96), its difficulties "in various respects" (Witherington, 1998, p. 136), and its "severe problems" (Barrett, 2008, p. 121). Therefore, there are still ambiguities regarding the nature of the people attending the festival (i.e. were they visitors or residents?).

## 3.2 | General research question and methodology

To solve the ambiguities regarding the nations attending the festival, this article explores questions like: Who are the audience, are they visitors or settlers from the diaspora? Does the list of nations show resemblance with contemporary literature considering content or geographical arrangement? What is the specific meaning of the reference to Judaea, which several commentators regarded as inauthentic (and thus incorrect) and has led to several speculations to improve the text?

The exploration of the text will be accomplished using geographical and spatial perspectives and employing GIS tools. In our case studies, we used ArcMap, ArcGIS Online, FME, and Microsoft Excel software, as well as Python and R scripting. For the text of study, the Greek text was used. Data were derived from online websites like http://www.orbis.stanford.edu and http://www.pleiades.stoa.org.[6]

To obtain the spatial data that we needed for this study (i.e. the geographical locations of nations in Acts 2:9–11 and contemporary texts), we interactively identified these geographical entities from the textual sources (e.g. Bible texts, ancient authors, commentaries, dictionaries, and web sources). In a next step, we georeferenced the identified geographical entities using the coordinates stored in Pleiades. We have reviewed and corrected the linkages, which was necessary since some toponyms are used for more than one place (e.g. *Caesarea* was used to indicate Caesarea Maritma, Caesarea Phillipi, Caesarea in Cappadocia, and Caesarea in Phrygia).[7]

## 4 | CASE STUDIES

This section describes, for each of the three case studies: the research questions, the research methodology, the results and conclusions.

## 4.1 | Case study 1: Network analysis to gain insights into the identity of the audience

One of the issues regarding Acts 2:5, 9–11 concerns the identity of the audience. Acts 2:5 identifies them with the Greek word *katoikountes*: "pious Jews from every nation under heaven dwelling in Jerusalem," which "recognised the indigenous languages and dialects of their native lands" (Bruce, 1988, p. 54). But were the people in the audience residents of Jerusalem, who migrated from the Jewish diaspora colonies (Johnson, 1992) or visitors to the festival and residents of respectively Mesopotamia, Judaea, Cappadocia, etc. who traveled to Jerusalem to attend the religious festival (Bruce, 1988)?[8] Until now, answers to these questions have been sought in three directions.

The first direction is based on syntactical analysis.[9] Witherington (1998) argues to contrast *katoikountes* (residents) with *epidemountes* (visitors). That is, only the Romans are indicated as visitors. This might be explained "because of the narrative's geographical goal (28:11–31)," or as a possible allusion of "how there came to be a Christian community in Rome prior to the arrival of Paul or Peter or other major missionaries," or to distinguish between provincials and roman citizens (Keener, 2012; Witherington, 1998).

**TABLE 1** Locations in Acts 2 and their chosen equivalents in Orbis

| Acts 2 | Orbis |
|---|---|
| Jerusalem | Ierusalem |
| Parthia | Ad fl. Tigrum |
| Media | Ad fl. Tigrum |
| Elam | Ad fl. Tigrum |
| Mesopotamia | Dura |
| Judaea | Ascalon |
| Cappadocia | Caesarea (Cappadocia) |
| Pontus | Nico polis (Pontus) |
| Asia | Pergamum |
| Phrygia | Caesarea (Phrygia) |
| Pamphylia | Side |
| Egypt | Alexandria |
| Libya | Kardamis |
| Cyrene | Cyrene |
| Rome | Roma |
| Crete | Chersonasos |
| Arabia | Petra |

The second direction (i.e. most English Bibles) translates the word *katoikountes* as residents and the general usage of the noun throughout the book of Acts[10] indeed indicates permanent settlement. However, in the direct context the term is used in 2:5 for residents of Jerusalem and in 2:10 for those of Mesopotamia. As Keener states: "they cannot be both long-term residents of Mesopotamia in 2:10 and long-term residents of Judea in 2:5" (2012, p. 833, n. 452). This direction is therefore arguing against an exclusive meaning of *katoikountes* (i.e. they may also include visitors).

Finally, the third direction compares the descriptions about the audience at Pentecost of the Bible with extra-biblical sources. Josephus (Ant. 14.337) refers to large crowds from outside Jerusalem, attending Pentecost, but Johnson (1992) suggests references to a mixed population in Jerusalem. Neither of these interpretations settle the case,[11] since Acts 6:9 could be interpreted to favor the interpretation of *katoikountes* as returned diaspora Jews and, hence, long-term settlers.

In conclusion, the evidence about the identity of the audience is not convincing for either position: "Luke – the author of Acts – simply does not sacrifice the space to explain this detail. [...] Certainly, there must have been many visitors for the festival [...], and perhaps Luke would have included temporary residents who stayed for the seven weeks after Passover among his *katoikountes*" (Keener, 2012, p. 834).

### 4.1.1 | Research questions and methodology

Assuming that at least some of the participants had been traveling toward Jerusalem as visitors, relevant questions to shed more light on the nations mentioned are: What routes could have been taken; what influence did the time of year (and therefore the weather) have on the travels? Is it possible, from such information, to verify from which regions the visitors could have traveled?

To answer these questions, we use Orbis: the Stanford Geospatial Network Model of the Roman World.[12] This is an online tool for route planning in the ancient Mediterranean which considers many factors that have an impact on

**TABLE 2** Travel condition parameters used in the analysis

| Parameter | Value |
| --- | --- |
| Network modes – road | True |
| Network modes – river | True |
| Network modes – open sea | True |
| Network modes – coastal sea | True |
| Network modes – high resolution | False |
| Mode – road | Foot (30 km/day) (donkey)[a] |
| Mode – river | Civilian |
| Mode – sea | Fast |
| Transfer costs – river | 0 |
| Transfer costs – sea | 0 |

[a]Remarkably, the option "Foot (30 km/day)" is not available as a parameter value when the priority type is changed to cheapest in Orbis.

travel time, like the season of travel (i.e. May in the case of the studied festival). For example, in ancient times, traveling in summer conditions was significantly easier than in winter conditions when fewer ships were sailing.

We interactively identified *points of departure* and *destination* for the geographical areas mentioned in Acts 2:9–11, choosing the most central location for each area. Unfortunately, the Orbis tool does not cover the geographical extent of all areas mentioned in Acts 2. Hence, the most eastern location available in Orbis, which is Ad fl. Tigrum, was selected as the point of departure for the areas of Parthia, Media, and Elam. Dura, which is the most southern location along the River Euphrates, was selected for Mesopotamia, and Kardamis was selected as the most central location for Libya. Orbis' entry *Ierusalem* (Jerusalem) was identified as destination. The resulting map, with points of departure and destination, is shown in Table 1.

The *date of Pentecost* depends on Passover. Although several issues obscure the date of Passover,[13] we make the following assumptions: Jews celebrated Passover on "the 14th day of the first month" (Num. 28:16, Lev. 23:5, Josh. 5:10) [i.e. the Hebrew month Nisan, starting at the spring new moon (Abegg, 1997)]. This would have been somewhere in the second half of March or the first half of April. From this, we can conclude that Pentecost was likely to be in the second half of May or the first half of June (Barclay, 2003; Currid & Barrett, 2010).

To calculate the travel distances in Orbis, one must select parameter values for aspects like network modes, travel modes, and transfer costs. Table 2 shows our choices for the parameter values which best reflect the possibilities that the travelers had.

We have calculated three routes for each departure location based on the available priority types: cheapest, shortest, and fastest. Because pious Jews would not travel on the Sabbath, we corrected the travel time by dividing each output by 6 (days) and subsequently multiplying it by 7 (days). Finally, Euclidean distances between points of departure and Jerusalem were calculated[14] to provide proximity information between the points of departure and the destination, to give map readers a sense of the distances.

### 4.1.2 | Results

Tables 3 and 4 show the results of these network analyses, and Figures 2 and 3 show the graphs representing, respectively, travel distances and travel duration. The graph in Figure 2 shows the travel distance in kilometers for each point of departure differentiated by four routing preferences: cheapest, shortest, fastest, and Euclidean distance. Figure 3 shows the number of days that it took in traveling one of the selected alternatives. As mentioned before, this travel duration time has been corrected to account for the Sabbath.

**TABLE 3** Travel distance and duration between points of departure and Jerusalem

| | May | | | | | | June | | | | | |
| | Cheapest | | Fastest | | Shortest | | Cheapest | | Fastest | | Shortest | |
| | Duration | Distance | Duration | Distance | Duration | Distance | Duration | Distance | Duration | Distance | Duration | Distance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ad fl. Tigrum | 60.6 | 1,758 | 27.5 | 1,317 | 37.2 | 1,115 | 60.9 | 1,758 | 27.7 | 1,317 | 37.2 | 1,115 |
| Dura | 58.2 | 1,460 | 29.3 | 1,369 | 30.4 | 912 | 58.4 | 1,460 | 29.5 | 1,369 | 30.4 | 912 |
| Ascalon | 2.6 | 143 | 2.6 | 77 | 2.6 | 77 | 2.7 | 143 | 2.6 | 77 | 2.6 | 77 |
| Caesarea (Cappadocia) | 18.9 | 1,142 | 20.1 | 1,142 | 30.9 | 1,026 | 19.1 | 1,142 | 20.3 | 1,142 | 30.8 | 1,026 |
| Nicopolis (Pontus) | 29.3 | 3,177 | 30.5 | 3,177 | 45.9 | 1,323 | 29 | 3,178 | 30.2 | 3,178 | 45.9 | 1,323 |
| Pergamum | 12.7 | 1,671 | 12.7 | 1,671 | 15.7 | 1,365 | 12.8 | 1,672 | 12.8 | 1,672 | 15.8 | 1,366 |
| Caesarea (Phrygia) | 15.6 | 1,098 | 15.6 | 1,098 | 17.5 | 1,040 | 15.9 | 1,098 | 15.9 | 1,098 | 17.8 | 1,040 |
| Side | 6.3 | 755 | 6.3 | 755 | 7.3 | 734 | 6.7 | 755 | 6.7 | 755 | 7.6 | 734 |
| Alexandria | 6.2 | 737 | 6.2 | 670 | 26.6 | 582 | 6.7 | 737 | 6.6 | 670 | 26.6 | 582 |
| Kardamis | 9.7 | 1,293 | 9.6 | 1,226 | 35.7 | 1,121 | 10.6 | 1,293 | 10.6 | 1,226 | 35.9 | 1,121 |
| Cyrene | 12.9 | 1,713 | 12.8 | 1,647 | 47.6 | 1,432 | 14.1 | 1,713 | 14 | 1,647 | 47.8 | 1,432 |
| Roma | 20.4 | 3,048 | 20.4 | 2,982 | 33.3 | 2,769 | 20.4 | 3,058 | 20.4 | 3,058 | 33.1 | 2,770 |
| Chersonasos | 9.6 | 1,329 | 9.6 | 1,329 | 10.6 | 1,308 | 9.7 | 1,330 | 9.7 | 1,330 | 10.7 | 1,309 |
| Petra | 8.9 | 354 | 8.9 | 288 | 9.5 | 286 | 9 | 354 | 8.9 | 288 | 9.5 | 286 |
| | days | km | days | km | days | km | days | km | days | km | days | km |

**TABLE 4** Travel duration, corrected for the Sabbath

| Toponym in Acts | Orbis (point of departure) | May | | | June | | |
|---|---|---|---|---|---|---|---|
| | | Cheapest | Fastest | Shortest | Cheapest | Fastest | Shortest |
| Parthia, Media, Elam | Ad fl. Tigrum | 70.7 | 32.1 | 43.4 | 71.1 | 32.3 | 43.4 |
| Mesopotamia | Dura | 67.9 | 34.2 | 35.5 | 68.1 | 34.4 | 35.5 |
| Judaea | Ascalon | 3.0 | 3.0 | 3.1 | 3.2 | 3.0 | 3.0 |
| Cappadocia | Caesarea (Cappadocia) | 22.1 | 23.5 | 36.1 | 22.3 | 23.7 | 35.9 |
| Pontus | Nicopolis (Pontus) | 34.2 | 35.6 | 53.6 | 33.8 | 35.2 | 53.6 |
| Asia | Pergamum | 14.8 | 14.8 | 18.3 | 14.9 | 14.9 | 18.4 |
| Phrygia | Caesarea (Phrygia) | 18.2 | 18.2 | 20.4 | 18.6 | 18.6 | 20.8 |
| Pamphylia | Side | 7.4 | 7.4 | 8.5 | 7.8 | 7.8 | 8.9 |
| Egypt | Alexandria | 7.2 | 7.2 | 31.0 | 7.8 | 7.7 | 31.0 |
| Libya | Kardamis | 11.3 | 11.2 | 41.7 | 12.4 | 12.4 | 41.9 |
| Cyrene | Cyrene | 15.1 | 14.9 | 55.5 | 16.45 | 16.3 | 55.8 |
| Rome | Roma | 23.8 | 23.8 | 38.9 | 23.8 | 23.8 | 38.6 |
| Creta | Chersonasos | 11.2 | 11.2 | 12.4 | 11.3 | 11.3 | 12.5 |
| Arabia | Petra | 10.4 | 10.4 | 11.1 | 10.5 | 10.4 | 11.1 |

### 4.1.3 | Conclusion of case study 1

The questions of this case study were: What routes could travelers have taken from their homes to Jerusalem, what influence did the time of year (and therefore the weather) have on the travels? Is it possible, from such information, to verify from which regions the visitors could have traveled? Our experiments give answers to these questions, since
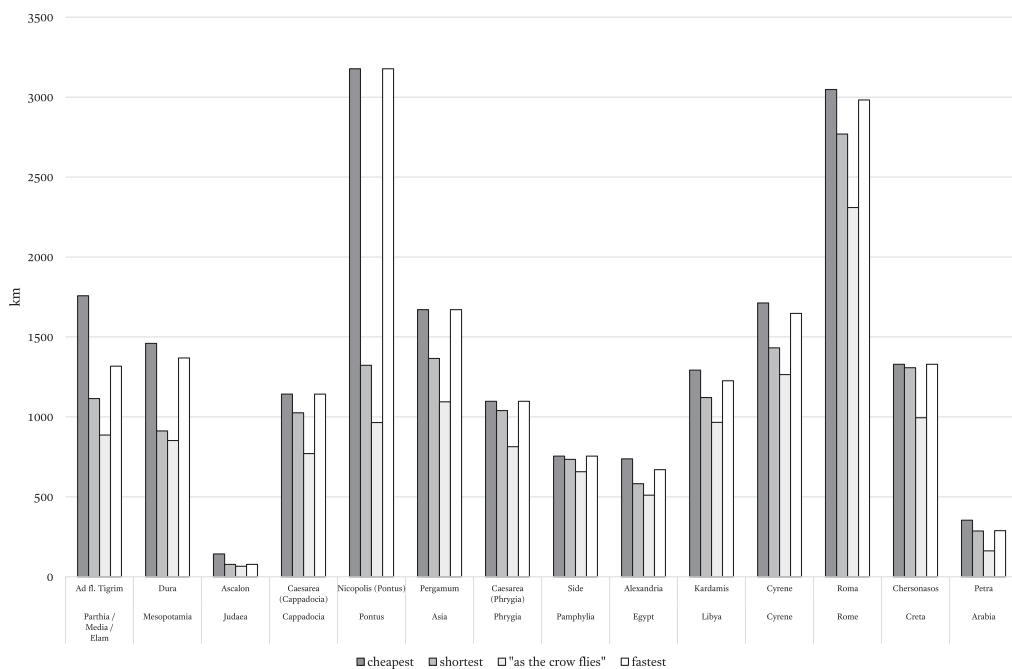


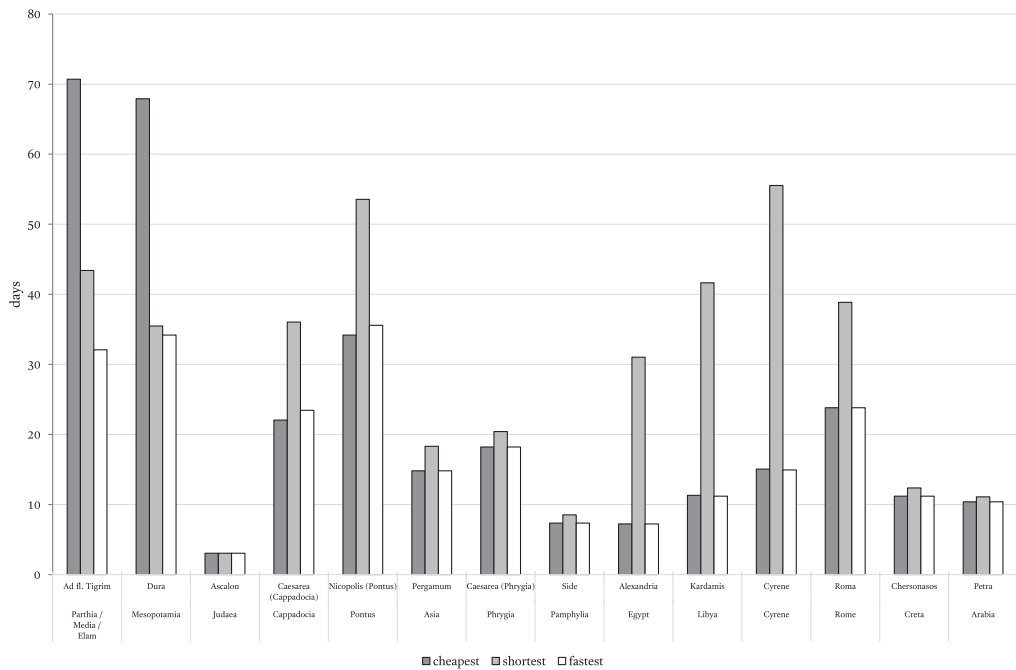**FIGURE 2** Travel distances (km) toward Jerusalem

**FIGURE 3** Travel duration (days) toward Jerusalem

they reveal the possible traveling patterns and provide additional insights about the transport networks, their availability during the seasons, and the required costs for traveling. From the results, we can draw two conclusions.

First, if there were non-residents among the *katoikountes*, they must have had more than average financial resources to afford traveling and being away for a longer period. The results show a duration ranging from 3 days up to 71 days for the cheapest route and ranging from 3 days up to 36 days for the fastest route to Jerusalem in May (Table 4), depending on the point of departure. Traveling was quite an endeavor and was, besides the extensive Roman road network, dependent upon seafaring. It therefore required the financial luxury of allowing one to be away from home for a longer period. We cannot be conclusive about the identity of the audience, but if we assume that they were non-residents, we can conclude that most of them must have had a good financial condition to be able to travel to Jerusalem.

Second, our results show that travel time is not directly related to distance or cost, and therefore possible travel distances are far from trivial. These insights give further background to the nations mentioned in the list in Acts 2: travelers who came from closer locations do not per se have shorter travel times. Compare, for example, the number of days for the cheapest and fastest routes from Dura (Mesopotamia), and Caesarea (Phrygia) to Jerusalem (i.e. 68 and 34, and 18 and 18, respectively) with the Euclidian distances from these locations to Jerusalem (i.e. 912 and 1,040 km, respectively).

## 4.2 | Case study 2: Cartographic visualization as a tool to compare ancient catalogues of nations

Case study 2 addresses the question of how to interpret the list of nations mentioned in Acts 2. There are two explanations. First, the list indeed mentions the nations who attended the specific festival. Second, the list should not be interpreted literally but as a literary construct, conveying the idea of universality (Pervo, 2009).

Reasoning from the second option (which is the starting point in this case study), it is assumed that the author of Acts might have based their list on two different ancient geographical traditions. The first option is that the list in Acts 2 stands in the tradition of astrological geography [cf. Halévy (1906) and Burkitt in Cumont

**TABLE 5**  Alleged parallels between Paulus Alexandrinus and Acts

| Sign | Paul of Alexandria | Acts 2:9–11 |
|---|---|---|
| Ram (Aries) | Persia | Parthians, Medians and Elamites |
| Bull (Taurus) | Babylonia | Mesopotamia |
| Twins (Gemini) | Cappadocia | Cappadocia |
| Crab (Cancer) | Armenia | Pontus |
| Lion (Leo) | Asia | Asia |
| Virgin (Virgo) | Hellas, Ionia | Phrygia and Pamphylia |
| Scales (Libra) | Libya, Cyrene | Parts of Libya near Cyrene |
| Scorpion (Scorpio) | Italy | Romans |
| Archer (Sagittarius) | Cilicia, Crete | Cretans |
| Ibex (Capricorn) | Syria | Judea |
| Water carrier (Aquarius) | Egypt | Egypt |
| Fish (Pisces) | Red Sea, India | Arabians |

*Note*: Weinstock (1948), Brinkman (1963), and Keener (2012) have different names for the signs of the zodiac.

(1909)]. Weinstock (1948) and Brinkman (1963) elaborated this suggestion by identifying parallels with the list in the Rudiments of Paulus Alexandrinus, a writing from the 4th century AD which classifies countries by the signs of the zodiac. They assumed both lists to correspond on several features (cf. Table 5). This text originates from at least two centuries after the text of Acts 2 is expected to have been written, but it is assumed that it uses the same source (i.e. the signs of the zodiac).

The second group of scholars regard "accounts of the distribution of the Jews throughout the world" (Barrett, 2008, p. 122) as providing the closest analogy to the list in Acts 2. These accounts have been found in contemporary Jewish authors like Josephus (Apion 2.282; War 2.398; War 7.43; Ant. 14.114–8; Ant. 15.21) and Philo (Flacc. 45f. and especially Leg. Ad Gaium 281f.).

In this case study, the list in Acts 2 is further studied against the background of these two geographical traditions.
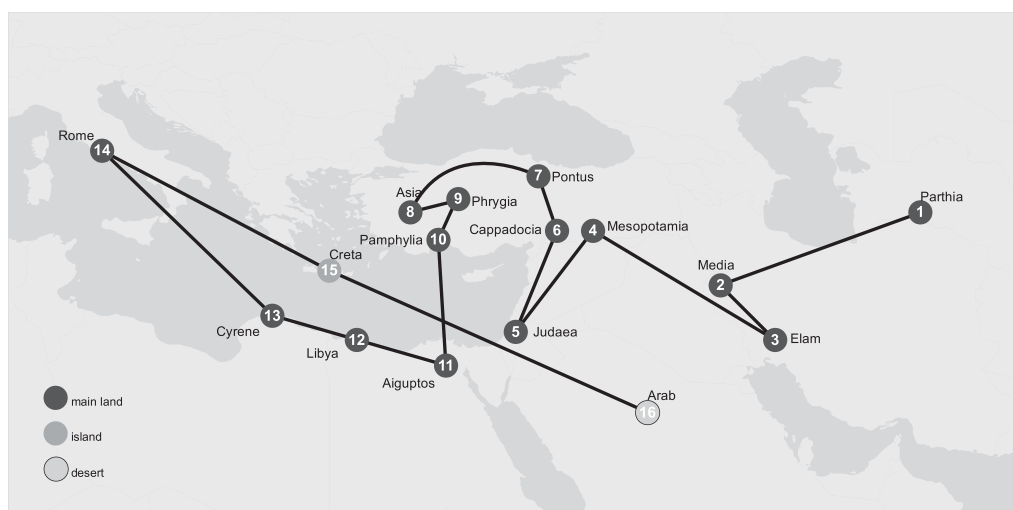


**FIGURE 4**  Locations in Acts 2 uncategorized

**FIGURE 5** Geographical list in the Rudiments of Paulus Alexandrinus

### 4.2.1 | Research question and methodology

The question of this case study is: Can we obtain new insights from plotting the locations enumerated in different geographical lists on a map and will this enable us to assess and evaluate the suggested backgrounds to the list of nations in Acts 2?

To answer this question, we have conducted a literature study and reconstructed the geographies behind Acts 2 and two contemporary catalogues of nations (i.e. the Rudiments of Paulus Alexandrinus and Philo). We connected the locations in these lists according to the order in which they appear using the algorithm Points to Line in ArcMap.

### 4.2.2 | Results

The results are visualized in Figures 4–6.[15]



**FIGURE 6** Geographical clusters in Philo's list of nations

**FIGURE 7** Locations in Acts 2 categorized

**Results for the first suggestion: Signs of the zodiac**

Although the studies of Bruce[16] and Metzger (1970) make it improbable to uphold the view of exclusive dependencies between the two lists, and nowadays the theory is regarded as obsolete (Barrett, 2008), it nevertheless remains relevant to compare the arrangement of Paulus' list (Figure 5) with the catalogue in Acts 2 (Figure 4). The overall geographical extent and arrangement show some resemblance with Acts 2. On closer inspection, both lists do start with a similar ordering, but later the two lists do not hold a real resemblance.

On comparison of the individual locations we can indeed reconfirm the conclusion of Metzger, on the basis of his linguistic analysis, that there is not much resemblance (only five actual parallels) between the two catalogues. Instead, we can conclude that both Acts 2 and Paulus' Rudiments "resemble the more general form of lists of nations" (Keener, 2012, p. 840).

**Results for the second suggestion: Jewish catalogues of nations**

The second suggestion is that in Acts 2 Luke stands in the tradition of lists describing "the distribution of the Jews throughout the world" (Barrett, 2008, p. 122). Although Barrett (2008) concludes that there is no question of dependency or a common source, he regards the list in Philo (Leg. Ad Gaium 281f.) as interesting because of its similar form.

At first glance, the maps based respectively on Philo's lists (Figure 6) and Acts 2 (Figure 4) show little resemblance, due to their difference in starting point. However, Philo distinguishes between main lands, islands, and lands beyond the Euphrates (Embassy 281–2) and in Leg. Ad Gaium 281f. he classifies the countries as: close neighbors of Judea (1–4); settlements in Asia Minor (5–9); cities in Europe (10–18); isles (19–21); and the remainder beyond the Euphrates (22).

At the risk of superimposing a structure on the list of nations in Acts 2, both the main classification into mainland, islands, and desert and the regional subdivision have been projected onto the list in Acts 2, resulting in Figure 7. As can be seen from this figure, both structures can be perceived in the list in Acts 2 and therefore we can conclude that there is a certain resemblance between the lists in Acts 2 and the lists of Philo.

### 4.2.3 | Conclusion of case study 2

The question of this case study was: Can we better evaluate the suggested backgrounds to the list of nations in Acts 2 by plotting the locations enumerated in different geographical lists on a map? From our research, we can draw some conclusions.

Cartographical portrayal of the related geographical concepts (i.e. showing the locations mentioned in the text on a map) provides new insights for this dispute (i.e. it reconfirms that the list in Acts 2 unlikely found its background in astrological geography, while a background in Jewish diaspora lists looks more realistic).

**FIGURE 8** Interface of ADNTCE

**FIGURE 9** Alternative locations to Judea

The maps indeed conceal dissimilarities between locations in Paulus Alexandrinus and Acts 2 (first suggestion). At the same time, the comparison of the catalogue in Acts 2 with the list of nations in Philo (second suggestion) does show similarities, specifically when projecting the classifications of Philo's list onto the list in Acts 2. This projection showed that both lists contain similar groupings. These insights can help to further assess the different interpretations of Acts 2.

## 4.3 | Case study 3: Spatial analysis as a tool for conjectural criticism

How certain can one be that the text under study resembles the text as originally written by the author? Answering this question is the objective of the discipline of textual criticism (which is not limited to biblical studies) and the topic of the third case study.

The *autographa* (original manuscripts from the hands of the original authors) are not available, and the texts have been transferred from generation to generation. Complete copies of the New Testament Canon are only known from the 4th century (Codex Sinaiticus) and onward, but copies of individual books, fragments, or even individual glosses originate from much earlier (even ca. AD 125 for $\mathfrak{P}^{52}$, the earliest known, business-card-size fragment of the Gospel of John) [cf. Metzger and Ehrman (2005)]. Besides many resemblances in the manuscripts available for one biblical text, several differences exist in punctuation, or (mis-)spelling, and also in alterations of words or omission of complete verses or paragraphs.[17]

### 4.3.1 | Textual and conjectural criticism

To overcome these differences, the discipline of textual criticism aims to establish the original text from the available variants and applies a number of generally agreed principles (Metzger & Ehrman, 2005). Traditionally, the discipline is concerned with existing variant readings from manuscripts and lectionaries. However, the researcher analyzing the text often faces difficulties in the text (e.g. logical contradictions, inconsistencies) which could not be solved by opting for a different text variant. This leads to the assumption that the text was corrupted during its transmission. To overcome these difficulties in the text, "the editor's only remaining resource is to conjecture what the original reading must have been" (Metzger & Ehrman, 2005, pp. 226–227).

Conjectural criticism is the discipline which studies the proposed alternatives of the original text (i.e. conjectural emendations) systematically. An important tool in this regard is the Amsterdam Database of New Testament Conjectural Emendation (ADNTCE) (Krans & Lietaert Peerbolte, n.d.) containing a collection of approximately 6,500 conjectures for the New Testament and providing data on the discussion of particular emendations.[18]
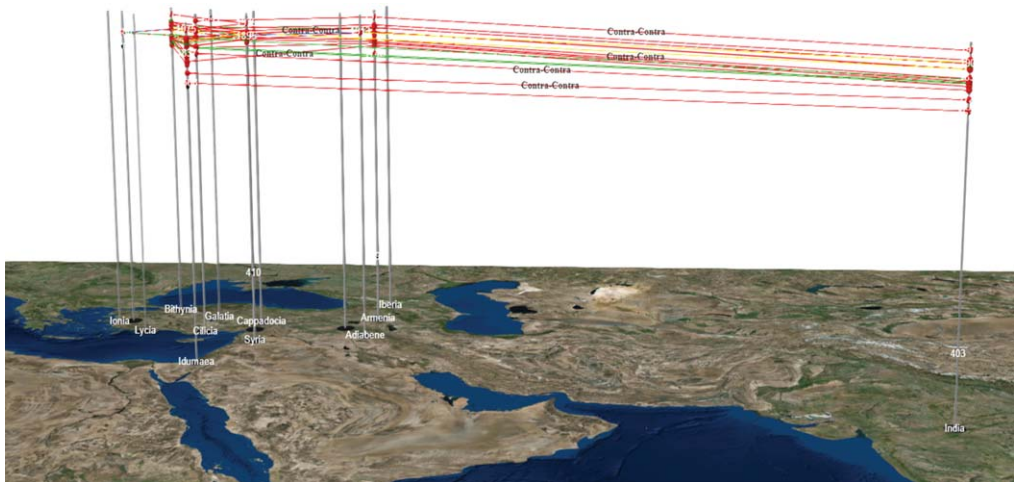
**FIGURE 10** Space–time cube for conjectural emendations in Acts 2:9

The great profit of the ADNTCE is that it has collected all known conjectures and made the data available on the internet. Unfortunately, the data is presented in tabular form, which restricts analysis to individual conjectures and makes an analysis of the filiation of conjectures difficult (cf. Figure 8).

### 4.3.2 | Judaea in Acts 2

Until today, the reference to *Judaea* in Acts 2:9 has troubled several scholars. To provide more insights into the discussion of the authenticity of *Judaea* in Acts 2:9 we applied spatio-temporal analysis.

Already in the 8th century AD Bede, an English monk, pointed out that the reference to Jews in Acts 2:9 seems a bit awkward (Bruce, 1988). The list refers to Jews anyway and it is deemed unlikely that Judaeans, as residing in Jerusalem, would be specifically mentioned (Barrett, 2008; Bruce, 1988; Metzger, 1970; Witherington, 1998).

Furthermore, *Judaea* comes quite unexpectedly in the geographical arrangement of the nations (Barrett, 2008), between Mesopotamia in the east and Cappadocia in the north (Bishop, 1952; Metzger, 1970; Witherington, 1998) (cf. Figure 7), where Judaea creates a "spike" in the geographical arrangement.

Some scholars (Barrett, 2008; Bruce, 1988; Metzger, 1970) also mention that *Judaea* is properly an adjective due to the absence of the article. Barrett, however, objects to this view by referring to Turner, who noted *Prhygian kai Pamphylian* in v. 10 also as adjectives.

These three arguments led many to assume a scribal error, but this assumption has never gained wide acceptance since the manuscripts show "little sign of textual corruption" (Barrett, 2008, p. 121). However, a "number of textual variants [...] show the difficulty was felt early on,"[19] and 22 conjectural emendations have been proposed over the centuries.[20] Some scholars solved the problem by simply omitting Judaea. Others changed the punctuation or slightly altered the spelling of Judaea into Judaean, thereby changing it into an adjective to Mesopotamia.

The vast majority of critics showed more rigor, and exchanged Judaea for an alternative location. To date, at least 18[21] alternative geographical locations are known to have been suggested: Cilicia, Armenia, Ida (mountain range on Crete), Junia, Ionia, Jaudi, Iberia, Bithynia, Adiabene, Aramea, Idumea, Lydia, Gordyaa, Lycia, Galatia, Gallia, India, and Syria (cf. Figure 9).[22]

### 4.3.3 | Research question and methodology

The question "In which way could geographical and spatial analysis contribute to the understanding of the textual and conjectural criticism of Acts 2:9?" is researched in two explorative experiments. Both experiments employ a similar methodology. All available conjectures on Judaea are analyzed in this study. They are placed in a two-dimensional space (the exact procedure differs per experiment and is explained below); classification and time (translated to *z*

**TABLE 6** Levenshtein distance matrix for conjectures on Judaea in Acts 2:9

| | Ἰουδαίαν | Ἰδουμαίαν | Λυδίαν | Ἰνδίαν | Γορδυαίαν | Κιλικίαν | Ἀρμενίαν | Βιθυνίαν | Καππαδοκίαν τε καὶ Λυδίαν | Συρίαν | Ἀδιαφαίαν | Ἀρμαχαίαν | Λυκίαν | Γαλατίαν | Γαλλίαν | Ἰωνίαν | Jaudi | Ἰβερίαν | Ἰουδαίαν Συρίαν | Ἰουδαῖοι | Ἰδαῖν | Ἰουναίαν |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ἰουδαίαν | | 2 | 3 | 3 | 3 | 5 | 5 | 5 | 20 | 4 | 5 | 4 | 4 | 5 | 5 | 14 | 8 | 4 | 7 | 3 | 4 | 2 |
| Ἰδουμαίαν | 2 | | 5 | 5 | 5 | 6 | 6 | 5 | 19 | 5 | 4 | 4 | 5 | 6 | 6 | 5 | 9 | 5 | 9 | 5 | 5 | 3 |
| Λυδίαν | 3 | 5 | | 2 | 5 | 5 | 5 | 4 | 19 | 2 | 6 | 5 | 1 | 5 | 4 | 3 | 6 | 4 | 10 | 6 | 5 | 4 |
| Ἰνδίαν | 3 | 5 | 2 | | 5 | 5 | 5 | 5 | 20 | 3 | 6 | 5 | 3 | 5 | 4 | 2 | 6 | 3 | 10 | 6 | 4 | 4 |
| Γορδυαίαν | 3 | 6 | 5 | 5 | | 6 | 5 | 5 | 20 | 5 | 5 | 4 | 5 | 5 | 5 | 6 | 9 | 6 | 9 | 6 | 6 | 4 |
| Κιλικίαν | 5 | 6 | 5 | 5 | 6 | | 5 | 4 | 20 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 8 | 5 | 12 | 8 | 6 | 5 |
| Ἀρμενίαν | 5 | 5 | 4 | 5 | 5 | 5 | | 4 | 21 | 5 | 5 | 3 | 5 | 5 | 5 | 4 | 8 | 4 | 11 | 8 | 7 | 5 |
| Βιθυνίαν | 5 | 5 | 4 | 5 | 5 | 4 | 4 | | 21 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 8 | 5 | 11 | 8 | 7 | 4 |
| Καππαδοκίαν τε καὶ Λυδίαν | 20 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | | 21 | 19 | 20 | 20 | 19 | 21 | 21 | 25 | 21 | 16 | 23 | 22 | 19 |
| Συρίαν | 4 | 5 | 2 | 3 | 5 | 5 | 5 | 4 | 21 | | 6 | 5 | 2 | 5 | 4 | 3 | 6 | 3 | 9 | 7 | 5 | 4 |
| Ἀδιαβαίαν | 5 | 4 | 6 | 6 | 5 | 5 | 5 | 5 | 19 | 6 | | 3 | 6 | 5 | 5 | 6 | 9 | 6 | 10 | 8 | 6 | 5 |

(Continues)

**TABLE 6** (Continued)

| | Ἰουναίαν | Ἰδαιῶν | Ἰουδαῖοι | Ἰουδαίαν Συρίαν | Ἰβηρίαν | Jaudi | Ἰωνίαν | Γαλλίαν | Γαλατίαν | Λυκίαν | Ἀραμαίαν | Ἀδιαβηνὴν | Συρίαν | Καππαδοκίαν τε καὶ Λυδίαν | Βιθυνίαν | Ἀρμενίαν | Κιλικίαν | Γοδρωσίαν | Ἰνδίαν | Λυδίαν | Ἰδουμαίαν | Ἰουδαίαν |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ἀραμαίαν | 4 | 6 | 7 | 10 | 5 | 8 | 5 | 4 | 4 | 5 | | 3 | 5 | 20 | 5 | 3 | 5 | 4 | 5 | 5 | 4 | 4 |
| Λυκίαν | 4 | 5 | 7 | 11 | 4 | 6 | 3 | 4 | 5 | | 5 | 6 | 2 | 20 | 4 | 5 | 4 | 5 | 3 | 1 | 5 | 4 |
| Γαλατίαν | 5 | 6 | 8 | 10 | 5 | 8 | 5 | 2 | | 5 | 4 | 5 | 5 | 19 | 5 | 5 | 4 | 5 | 5 | 5 | 6 | 5 |
| Γαλλίαν | 5 | 6 | 8 | 11 | 4 | 7 | 4 | | 2 | 4 | 4 | 5 | 4 | 21 | 5 | 5 | 4 | 5 | 4 | 4 | 6 | 5 |
| Ἰωνίαν | 4 | 4 | 6 | 10 | 3 | 6 | | 4 | 5 | 3 | 5 | 6 | 3 | 21 | 4 | 4 | 5 | 6 | 2 | 3 | 5 | 14 |
| Jaudi | 8 | 6 | 8 | 15 | 7 | | 6 | 7 | 8 | 6 | 8 | 9 | 6 | 25 | 8 | 8 | 8 | 9 | 6 | 6 | 9 | 8 |
| Ἰβηρίαν | 5 | 5 | 7 | 10 | | 7 | 3 | 4 | 5 | 4 | 5 | 6 | 3 | 21 | 5 | 4 | 5 | 6 | 3 | 4 | 5 | 4 |
| Ἰουδαίαν Συρίαν | 9 | 11 | 10 | | 10 | 15 | 10 | 11 | 10 | 11 | 10 | 10 | 9 | 16 | 11 | 11 | 12 | 9 | 10 | 10 | 9 | 7 |
| Ἰουδαῖοι | 5 | 5 | | 10 | 7 | 8 | 6 | 8 | 8 | 7 | 7 | 8 | 7 | 23 | 8 | 8 | 8 | 6 | 6 | 6 | 5 | 3 |
| Ἰδαιῶν | 6 | | 5 | 11 | 5 | 6 | 4 | 6 | 6 | 5 | 6 | 6 | 5 | 22 | 7 | 7 | 6 | 6 | 4 | 5 | 5 | 4 |
| Ἰουναίαν | | 6 | 5 | 9 | 5 | 8 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 19 | 4 | 5 | 5 | 4 | 4 | 4 | 3 | 2 |

**TABLE 7** Conjectures and their retrieved coordinates for two-dimensional space

| Conjecture | x | y |
| --- | --- | --- |
| Ἰουδαίαν | −0.155194756 | −5.94517 |
| Ἰδουμαίαν | 0.415989716 | −1.28429 |
| Λυδίαν | −0.193327432 | 0.77423 |
| Ἰνδίαν | −1.010417094 | 0.425551 |
| Γορδυαίαν | −0.333721302 | −1.39333 |
| Κιλικίαν | −0.837570304 | 1.794843 |
| Ἀρμενίαν | −1.541461548 | 0.942316 |
| Βιθυνίαν | −1.544529343 | 0.998521 |
| Καππαδοκίαν τε καὶ Λυδίαν | 18.89659144 | 2.065273 |
| Συρίαν | −1.681052182 | 0.053365 |
| Ἀδιαβαίαν | 0.499486505 | 0.288282 |
| Ἀραμαίαν | −0.60147486 | 0.039998 |
| Λυκίαν | −1.079746972 | 1.275264 |
| Γαλατίαν | 0.241551277 | 1.169667 |
| Γαλλίαν | −1.702566051 | 1.271331 |
| Ἰωνίαν | −1.846641371 | 5.057884 |
| Jaudi | −5.987122109 | 1.600186 |
| Ἰβερίαν | −1.694455232 | 0.318447 |
| Ἰουδαίαν Συρίαν | 5.64067356 | −4.44057 |
| Ἰουδαῖοι | −3.010299976 | −3.64394 |
| Ἰδαιᾶν | −2.684910532 | −0.77808 |
| Ἰουναίαν | 0.210198567 | −0.58978 |

coordinates) are added for each occurrence of a conjecture; the filiations in the discussion on alternatives for Judaea are reconstructed from the administration as geometric objects; and finally, the data is visualized in a space–time cube.[23]
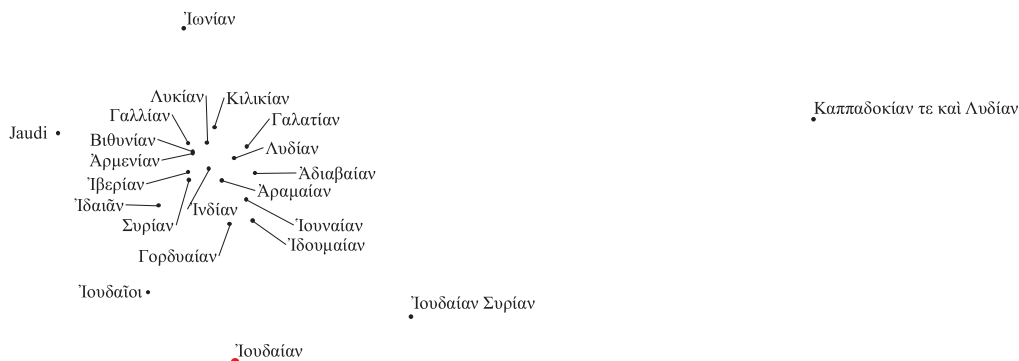


**FIGURE 11** Two-dimensional transcriptional proximity space for conjectures on Judaea in Acts 2:9 (http://vpvanaltena.nl/output/publications/advancing-new-testament-interpretation-through-spatio-temporal-analysis/#experiment-2)

### 4.3.4 | Experiment 1: Conjectures in geographical space

To create representations of the suggested alternative geographical locations for Judea in geographical space, the appropriate Pleiades ID was identified for each conjecture and thereby the geographical x, y coordinates were attributed. In a next step, we reviewed, corrected, and translated these to point geometries. Finally, we visualized and analyzed the data in a space–time cube (cf. Figure 10).[24]

From the resulting interactive space–time cube in Figure 10, we can make the following observations. It confirms that the intensity of the discussion on a particular conjecture differs significantly (which can already be observed by manually equating the discussion in the online database). Our visualization in a space–time cube has, however, the additional value that it provides the researcher with an overall view on the data and reveals the filiation between the individual conjectures. It can be observed, for instance, that the refutation of a particular conjecture often results in a new speculation, which we make visible with horizontal lines.

The geographical space–time cube enables the researcher to evaluate these proposals according to their location (which is important in the case of Acts, since one of the arguments for the corruption of Judaea is its assumed misfit within the geographical list). This visualization provides insights when geographical location was a main driver for the proposed conjecture.

### 4.3.5 | Experiment 2: Conjectures in "transcriptional proximity" space

The usage of a space–time cube does not have to be limited to geographical features in texts and, therefore, it is interesting to research its applicability to visualize the proximity relations between alternative glosses.[25]

Glosses are intuitively evaluated on a scale of proximity which can be based on referentiality or appearance (i.e. to quantify how similar two words are). This is explained by comparing *deer*, *beer*, and *hound*. When equating the real-world entities to which these three glosses refer, *deer* and *hound* correspond on category (animals), while *beer* does not show a resemblance in category (drinks). *Beer* is, however, relatively close to *deer* in literal appearance. It only requires the alteration of the letter b into the letter d, while *hound* is distant to *deer* and *beer*: it requires the substitution of all four letters and the insertion of a fifth letter. During transcription, it is more likely to confuse *deer* for *beer* than for *hound*.

This transcriptional proximity is used to estimate the most probable alternative for a number of glosses. Levenshtein (1966) developed a metric to calculate the edit distance between words. This distance is the minimal number of insertions, deletions, and substitutions of one character for another to transform one string into another. The metric is used in information theory, linguistics, and computer science (Navarro, 2001).

The Levenshtein distance is a valid but simple representation of distances between these conjectures, and it can be used to demonstrate the method of translating transcriptional proximity into a space–time cube. However, it should be noted that it requires pre-processing for equating words in different alphabets,[26] and needs more sophistication to add weighted distances for both edit operations[27] and specific letter combinations.[28]

Returning to the proposed conjectural emendations for *Judaea* in Acts 2:9, we calculated the reciprocal Levenshtein distances for each combination of conjectures and created a distance matrix to represent the proximity for each combination (cf. Table 6).

We also translated these distances into a Euclidean space by using classical multi-dimensional scaling (cMDS),[29] resulting in coordinates which represent the transcriptional proximity of the proposed conjectures. These coordinates can be displayed and analyzed in a two-dimensional space (cf. Table 7 and Figure 11).

By adding the classification system of the conjectures as attributes and translating the data into three-dimensional space, the data becomes suitable to be visualized and analyzed in a space–time cube.

We must be cautious when drawing conclusions about the probability of individual conjectures on the basis of this preliminary experiment (see our remarks above on the need for a more sophisticated algorithm). However, our experiments do show that a more sophisticated translation into transcriptional proximity space will deliver fruitful insights on the likeliness of particular conjectures. The closer a conjecture is situated to the contested reading, the more likely it is that a transcriptional error might have occurred. Figure 11 clearly shows this function.

### 4.3.6 | Conclusion of case study 3

In this case study we visualized and spatially analyzed the filiation of conjectures on Acts 2:9 in a space–time cube. This provides new insights on the probability of particular conjectures. The insights still do not convincingly settle the case. However, they do contribute to the study of conjectural criticism, because they show solutions that are unlikely. In the case of Acts 2, "probably the least unsatisfactory solution to an admittedly difficult problem is to accept the reading attested by the overwhelming weight of witnesses" (Metzger, 1970, p. 133).[30]

Notwithstanding the fact that spatio temporal methods will not deliver conclusive statements about the original manuscripts, we can conclude that they contribute in the field of textual and conjectural criticism by providing tools for analysis of alternative spaces (i.e. geographical space and linguistic space), visualization of the mutual proximity of emendations, and the evaluation of data according to semantic analysis, geographical arrangement, and transcriptional proximity.

## 5 | CONCLUSIONS

In this article we explored the potential of using spatio temporal analysis for New Testament interpretation. Therefore, we conducted three case studies on a specific text from the Bible (Acts 2); a geographical visualization and network analysis to provide a better understanding of the geographical and social context of the attendees in Acts 2; a spatial analysis of suggested geographical arrangements of the nations mentioned; and, finally, an exploration of several proposals in the reconstruction of the original wording of the text by means of spatial analysis.

From these case studies it can be concluded that spatializing (i.e. assigning coordinates to location-oriented concepts), visualizing, and spatially analyzing geographical concepts from the texts in Acts 2 contribute to the field of New Testament interpretation. The application of network analysis on data representing the Roman road network (case study 1) constrained by parameters valid for ancient times has provided additional insights. Also, the application of cartographic visualization provides supportive information to equate contemporary textual resources (case study 2). For the disciplines of textual and conjectural criticism (case study 3), spatio temporal analysis opens a new window to study what would be the most probable variant of the original text. Spatio temporal analysis can contribute to the discussion on, and lineage of, suggested emendations and provide sophisticated tools for visualization and analyses.

In terms of directions for future research, the employed methodology could easily be used for additional case studies. For the book of Acts this could be found in a spatio temporal reconstruction of the various locations where (parts of) the book of Acts could possibly have been written. This, however, requires engagement with a considerable amount of debate within biblical studies, which is outside the scope of this article. Further work could also adapt the edit distance algorithms to better simulate the occurrence of transcriptional errors. Another possible area of future research is to reflect on the hermeneutical aspects of spatio temporal methods. In which way can these insights further contribute to the understanding of New Testament pericopes? We will address these directions in further research.

With the three case studies, we have shown that applying spatio temporal analysis provides New Testament interpretation with new methodological tools which take different perspectives into account simultaneously in a visual, geographical environment. This is a valuable hermeneutical asset [cf. Larsen and Benzek (2014, 2016, 2017)].

### ENDNOTES

[1] Compare Schreiner's comment: "A spatial turn is sweeping through the wider scholarly world in the social sciences, humanities, and philosophy. Across the disciplines, the study of space has undergone a profound and sustained resurgence" (Schreiner, 2016, p. 340).

[2] In a narrow definition, the discipline of hermeneutics is restricted to interpretation (Tate, 2006), and offers rules to interpret or even exclusively apply to the text. In a broad definition, the discipline is concerned with the nature of understanding itself (Porter, 2015). In addition to the applied methodology, the interpretive repertoire of the interpreter is under investigation. Not only the text, but also the interpreter is part of a historical, cultural, and ideological context. Hermeneutics in this broad sense, therefore, focuses on the analysis of the conscious and unconscious methical and ideological assumptions that play a role in interpretive methods.

[3] Brinkman (1963) sees this syntactical structure:

I. Πάρθοι καὶ Μῆδοι καὶ Ἐλαμῖται

καὶ

τὴν Μεσοποταμίαν,
Ἰουδαίαν τε καὶ Καππαδοκίαν

II. οἱ κατοικοῦντες     Πόντον καὶ τὴν Ἀσίαν

Φρυγίαν τε καὶ Παμφυλίαν
Αἴγυπτον καὶ τὰ μέρη τῆς Λιβύης
τῆς κατὰ Κυρήνην,

καὶ

III. οἱ ἐπιδημοῦντες     Ῥωμαῖοι,(Ἰουδαῖοί τε καὶ προσήλυτοι)

IV. Κρῆτες καὶ Ἄραβες

Brinkman notes that I and IV are gentilic substantives, while II and III are active participles and their modifiers [cf. Pervo (2009, p. 66)]. For the Greek text, cf. Aland et al. (2016).

[4] Barrett (2008, p. 121) [cf. Hengel (2000, p. 162)]. Races: I & IV. Nations: II & III.

[5] The term "diaspora" is used to refer to the dispersion of the Jewish people over the world. It was initiated when the northern part of the Jewish Kingdom was taken into captivity to Assyria, in 720 BC. In 586 BC, a second exile followed when the Babylonians besieged Jerusalem and took the southern part of the Jewish Kingdom into exile. However, though many Jews left their homeland by force, more chose deliberately to live outside of Judea, being either the offspring of Jewish captives or migrants seeking to improve the life of their family. In this sense, the diaspora was not a unique phenomenon: likewise, a Greek, Aramaic, and Phoenician dispersion existed due to the conquerings of Alexander the Great and his subsequent efforts to unify his empire. What sets the Jewish diaspora apart from the other dispersed peoples is the fact that it has caused theological reflection. From a "Palestinian" perspective, it was regarded as the consequence of disobedience to the Torah; however, from a "diaspora" perspective it seems to have been interpreted as the fulfilment of the promises given to Abraham (Josephus, Ant. 4.114–116, cf. Gen 12:1–3) [cf. Trebilco (1997), Trebilco and Evans (2000), Desilva (2013)].

[6] http://www.pleiades.stoa.org was initiated by the Ancient World Mapping Center and the Institute for the Study of the Ancient World. It aims to provide historical geographic information about the ancient world in digital form.

[7] All original data in this article will be provided at http://vpvanaltena.nl/output/data.

[8] Dunn (1986, p. 786) and Sleeman (2013, p. 96) escape the dilemma by stressing that the multitudes "represent 'every nation under heaven' (2:5)," but especially the comment of Sleeman should be read against his aims to explain the overarching concept of "ascension geography" in Acts.

[9] See note 3.

[10] 1:19; 4:16; 72, 4; 9:22, etc., however see 7:2, 4, which "might suggest temporary (but lengthy) residence as aliens" (Keener, 2012, p. 833, n. 450).

[11] Johnson refers to three locations in Josephus (War 1.397; War 1.437; War 1.672) which seem to imply the existence of a mixed population in Jerusalem. To me this inference seems illegitimate. It is unclear in which way these quotations from Josephus offer a direct connection with the public in Acts 2, or with Pentecost in general. They do not bring us much further than a general inference that the residents of Jerusalem consisted of both Jews as well as foreigners. Furthermore, these texts clearly indicate that these foreigners (Thracians, Gauls, and Germans) were all part of the guard of Herod (the Idumean King), which was established by Caesar (the Roman Emperor). This implies a heathen context and makes the identification with the audience in Acts 2 unlikely.

[12] Available at http://www.orbis.stanford.edu.

[13] For example, the existence of several calendars in the ancient world (Lacey, 1993); the dependence on the phase of the moon and a controversy between Qumran sectarians and Jewish rabbis about the starting point for the calculation of the 50-day period.

[14] The algorithm is available in ArcGIS – Analysis Tools – Proximity Near. Used parameter values are: Input features: Locations, Near Features: Jerusalem, Search Radius: <empty>, Location: False, Angle: False, Method: Geodesic.

[15] See the provisional results at http://vpvanaltena.nl/output/publications/advancing-new-testament-interpretation-through-spatio-temporal-analysis/#case-2.

[16] Which could be inferred from the quotation and discussion by Brinkman (1963, p. 422, n. 12). In his revised commentary (1988, pp. 55–59), Bruce still upholds this view.

[17] For example, the ending of the Gospel of Mark (Mc. 16:9–20).

[18] Implicitly it contains information about the filiation of a particular emendation and among alternatives by dating the discussion and classifying the suggestions using the categories: Urheber, Precursor, Contra, Mention, Discussion, Pro, Reinvention, and Other.

[19] Bishop (1952, p. 85), Witherington (1998, p. 136): "In the Bodleian there is an interesting MS. of the Acts and Epistles in Arabic, in which the list of 'devout men of every nation' starts with AKRAD, the plural of KURDI."

[20] Cf. the conjectures on Acts 2:9–11 in Krans and Lietaert Peerbolte (n.d.). Not all conjectures, however, offer an alternative geographical location.

[21] Syria and Judean Syria are counted as a single emendation.

[22] The Greek conjectures are: Κιλικίαν, Ἀρμενίαν, Ἰδαιᾶν, Ἰουναίαν, Ἰωνίαν, Jaudi, Ἰβερίαν, Βιθυνίαν, Ἀδιαβαίαν, Ἀραμαίαν, Ἰδουμαίαν, Λυδίαν, Γορδυαίαν, Λυκίαν, Γαλατίαν, Γαλλίαν, Ἰνδίαν, Συρίαν.

[23] In GIS, a 2D representation of space (*x, y* coordinates) supplemented by a third dimension representing time (*z* coordinates) is often called a space–time cube [cf. Arroyo Ohori, Ledoux, and Stoter (2017, p. 67), Kraak (2014, pp. 112–116)].

[24] See the provisional results at http://vpvanaltena.nl/output/publications/advancing-new-testament-interpretation-through-spatio-temporal-analysis/#experiment-1.

[25] The conference paper of Old (2000) sparked the idea to investigate the same method for an alternative spatial representation.

[26] That is, Greek, Latin, Hebrew.

[27] Are additions, deletions, and insertions of equal importance?

[28] The Greek letter Θ is more likely to be confused with O than with Σ. Likewise, should the confusion of the two letters IT with the letter Π (respectively Greek capital letters i, t, and p) be counted as one or two alterations?

[29] More background on cMDS can be found in Mardia (1978). Implementations of the algorithm exist in R and Python, as well as other programming languages.

[30] Cf. "Meines Erachtens ist es nicht angebracht in Apg. 2:9 eine Konjektur zu akzeptieren oder sogar in den Text aufzunehmen. Die Schwierigkeiten, die exegetischer, textkritischer, und historischer Art sind, sind vielleicht nicht zu lösen. Somit bleibt die Vielfalt von Konjekturen und anderer Vorschläge stehen als ebenso viele Zeugen dieser Schwierigkeiten" (Krans, 2016, p. 5).

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