TRAFFIC POLICY AND CIRCULATION IN ROMAN CITIES

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ABSTRACT

The Roman road-system (including urban street systems) is one of the most famous features of the Roman Empire. In cities, especially the older and smaller ones such as Pompeii, streets were narrower and not always suitable for (wheeled) two-way traffic or (wheeled) traffic at all; in later Hippodamic coloniae – as found in Western Europe like Xanten and Trier – streets were wide enough to cope with traffic. Local governments tried to keep traffic flow under control by means of legislation and creating fixed traffic circulation, including zigzag and parallel routes, and routes around the forum. The forum itself was never accessible for wheeled traffic, only for pedestrians.

Introduction

Throughout history, research into ancient Roman traffic circulation was an 'untrodden path'. The famous stepping-stones and wheel ruts in Pompeii, now typical touristic features, were for a long time not considered worthy of more detailed research. In 1991, the Japanese author Tsujimura published an article 'Ruts in Pompeii', but only after 2000 did more information appear on this theme, when Poehler,1 Van Tilburg,2 Laurence,3 Newsome4 and Kaiser,5 among others, published books and articles concerning traffic in this well preserved city.

Nowadays there is a growing interest in traffic, traffic circulation and congestion and even blocked arteries in other ancient, less well preserved

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3 Laurence 2008.
4 Newsome 2009.
5 Kaiser 2011a and b.
Roman cities. Was the traffic circulation here comparable with that of Pompeii or was it quite different? New research shows evidence that here, too, fixed traffic routes, which road-users were encouraged to follow, were quite usual.

Two cities in particular will be discussed: Pompeii and Xanten. These are both Roman cities, but their identities and features differ, as well as their infrastructures and traffic circulation. However, there are also similarities. In this article, I shall attempt to demonstrate the similarities and differences, and their backgrounds. The article will conclude with some aspects of town planning and traffic, particularly the infrastructure around fora and their corresponding traffic flow.

Pompeii: an old city built against the slope of a volcano

When Pompeii was destroyed in AD 79, the city was already six centuries old. Pompeii was probably founded in the 6th century BC as an Oscan settlement. This settlement (Altstadt) is still visible in the regions VII and VIII. In the 5th century, the city was extended to the north, region VI today. In the 4th century, the final and largest extension was built: the Samnitic extension east of the new *cardo* between Porta del Vesuvio and Porta di Stabia. The Forum, the centre of the Oscan settlement, remained in its original situation; a new Forum was not built at the intersection of the new *cardo* and *decumanus*. A reason for this is perhaps that the existing Forum was situated on the top of a hill, facilitating drainage. This street plan remained unaltered right up until Pompeii’s destruction in AD 79.

The street system of Pompeii

The three above-mentioned extension phases correspond with the street system. The oldest Oscan region, regions VII and VIII today, had a relatively irregular street pattern. Some streets were even winding, such as Via degli Augustali and Vicolo del Lupanare. Region VI has straight streets, running parallel with each other (apart from Via Consolare), but the corners are not at right angles; there are sharp as well as obtuse corners, and the *insulae* are diamond-shaped. Only the section to the east of the *cardo* (the Samnitic extension) shows the typical Graeco-Roman chessboard grid with right-angled corners and parallel-running streets. Only this part of the city incorporated thoroughfares, wide enough for two-way
Traffic circulation in Pompeii

Tsujimura and Wallace-Hadrill have mapped the street system with the varying depths of street ruts: deep, shallow, faint or none at all (fig. 1). According to present-day knowledge on this theme, it can be stated that east of the *cardo* the majority of streets have deep ruts; west of the *cardo* the street ruts have varying depths and sometimes no ruts at all.

The entire system of mainly one-way streets, blocked streets, closed streets, deep and/or shallow ruts show that traffic flow was not unrestricted, but that it followed fixed routes. These routes, however, could be altered by the local government or a group of civilians. An example of a completely blocked street is Vicolo di Tesmo.

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At the time of the volcanic eruption there were many building and restoration activities going on, not only in the Forum, but also along the pavements of certain streets. A lot of research has been done over the last few years concerning traffic flow, particularly in the regions VI and VII. At the corner of Via Consolare and Vicolo del Farmacista, a road section was repaved. Also along other streets in region VI, for instance Vicolo del Fauno to the west of the House of the Faun, there do not appear to be any ruts at all; here also it is evident that part of the street had been repaved. In other sections of region VI, traces of wear on stepping-stones, curb stones and corners indicate that the driving direction along Vicolo di Mercurius had been changed from eastbound to westbound (according to Poehler) – this street was a one-way street. More evidence that the street was planned for eastbound traffic is the street profile: every section of the street between two intersections has been widened slightly to the east; the widest part of the street section is the point just before the intersection, where the view was the best. Directly east of the intersection, the street section was narrowed again.

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12 Poehler 2005.
13 Poehler 2005.
14 Poehler 2005.
So traces of wear on stepping-stones and curb stones do not only indicate traffic intensity on the spot, but also the direction of the traffic. According to this information, traffic flow in the end-phase on the street section Porta di Ercolano–Via delle Terme (also region VII) can be determined: entering traffic, coming from Porta di Ercolano, drove along the route Via Consolare – Via delle Terme, but exiting traffic was able to use the route Via delle Terme – Vicolo di Modesto – Vico di Mercurio – Via Consolare. Unfortunately, it is uncertain as to whether this route was used frequently; one had to take a sharp bend to the left at the intersection Vico di Modesto–Vico di Mercurio, and the cornerstones at the south-west and south-east side of this intersection have disappeared. Sharp bends were unpopular, as will be discussed below. In region VII, the street system west of the Forum changed from a clearly-structured one into a chaotic one.

The depths of the ruts were not only created by the volume of traffic. Rainshowers and the constant flow of fountain water wore out the ruts further. Very remarkable are the ruts in Via degli Augustali; one can speak here of a ‘railway’ (fig. 2). It would be almost impossible for carts driving along a street to cause a rut with such sharp edges by wearing down the pavement; two carts could never follow the same track exactly. When passing stepping-stones they would do so, but in this situation there is in my opinion only one explanation: the ruts here must have been created by road menders. This hypothesis also dispels the problem of the extremely dense and also extremely orderly traffic flow; the depth has not been caused by carts, but by pick-axes. It must also have been more comfortable for the cart drivers while passing the stepping-stones. Such a ‘railway’ has also been found in Eleusis (Greece), where tracks in the road surface were cut out in order to prevent the jostling of the statues of the gods during processions. More evidence that these ruts were cut out manually is their sudden interruption some metres past the stepping-stone; maybe the ‘cutting-out’ project along this street was not yet finished when the eruption took place.

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The ruts and worn cornerstones prove that wheeled traffic in Pompeii must have been intensive; in combination with the mainly one-way streets, there must have been a lot of conflict going on among road-users. At present nothing is known about rights of way. According to Poehler, road-users drove on the right in Pompeii. However, in Britain road-users seem to have driven on the left, as proved by worn ruts in a quarry mine in the neighbourhood of Blunsdon Ridge, Swindon, between Oxford and Bristol.

Another theme not yet mentioned is the parking problem. Poehler, having researched parking facilities in Pompeii, identified 36 ramps, for instance at Vicolo del Lupanare (fig. 3), mainly giving access to a stable for parking cart(s) and animals; most of them are constructed for commercial destinations. Among them are a lot of inns, mainly situated in the neighbourhood of the city gates. The number of ramps in front of private houses is far lower, indicating that wheeled transport was mainly used for cargo transport.

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18 Right-hand driving in Pompeii: Poehler 2005; left-hand driving in Britain: Van Tilburg 2007:124 and 206 n. 862.
behalf of the reconstruction of the Forum, was at the end of Vicolo del Balcone Pensile, south of the Macellum.20

Due to the fact that it was almost impossible for an animal to walk backwards when facing oncoming traffic, fixed routes had to be followed, or someone had to precede the animal and/or cart, giving a sign (at a side street) that the street was clear.21 Illegally blocking a road or street could cause big problems. We do not have any information concerning the blocking of streets or the hindering of traffic in Pompeii outside legal rights, but in the southern Spanish city of Urso, there was a fine of 1000 sestercies for doing so.22

Obtuse corners in Pompeii

The aforementioned information tells us that Pompeii had a very dynamic traffic flow. Streets were regularly maintained, barricades were common and wheeled traffic was mainly one-way. The presence of traffic signs is

22 Lex Coloniae Genetivae Juliae CIII (CIL I2 594): *ne quis limites decumanos opsaeptos […] sestertios mille* (‘no person shall have the said boundary roads or cross roads blocked up […] 1000 sestercies’); Van Tilburg 2007:131-32.
doubtful; as far as we know, no traffic sign has been found. However, as shown by the (worn) ruts and curb stones, we can see that traffic made significantly more use of obtuse corners than sharp ones. A significant example of an ‘obtuse-cornered route’ is the detour which traffic was forced to take because of the barricade at the intersection of Via dell’Abbondanza and Via di Stabia (fig. 4).

This intersection must have been, in its original situation, the busiest point in the city. Via dell’Abbondanza widens between Vicolo del Lupanare and Via di Stabia; east of the intersection the street narrows as far as Porta di Sarno. Instead of building a new forum, the government chose to erect a barricade and to close off Via dell’Abbondanza for wheeled traffic. Wheeled traffic coming from Porta di Stabia with Porta di Nola as destination was able to turn right into Via dell’Abbondanza, but the detour past obtuse corners – although it took considerably longer – was preferred. Traffic was also able to use Via di Lupanare, but after the closing of this street, this route was no longer in use (fig. 5).

In region VI, too, obtuse corners have been found showing considerable wear on the curb stones. However, some sharp corners with worn sidewalk cornerstones have also been found, but the majority of them at obtuse corners. Presumably there was a fixed route system in use which the road-users kept to.

Xanten: a new city in a flat region

The city Colonia Ulpia Traiana (further named simply Xanten), which is today situated next to the mediaeval city of Xanten, close to the Dutch frontier, is a completely different city. The region was conquered by Julius Caesar, but it was during the reign of Emperor Augustus that the first Roman settlements were founded here: the military settlements Castra Vetera and Vetera II. There was no Roman city yet; it was in AD 98 that the city was founded by Emperor Trajan and acquired the status of colonia. It is the most northerly colonia of the continent. The city was planned and designed as a complete entity and did not have the history and gradual development of Pompeii in the form of extensions and lengthening of streets. Due to the fact that the city was built in a flat region, differences

in height did not play a significant role; drinking-water was supplied by an aqueduct coming from a nearby hill, and waste water drained away into the Rhine.

The street system of Xanten

At first sight, Xanten has the typical features of a Roman colonia: a chessboard grid plan, a striking cardo and decumanus including a forum at their intersection, a city wall equipped with towers at regular distances from each other, as well as the usual facilities of a normal Roman city: temples, baths and an amphitheatre (fig. 6).

However, looking more meticulously at the map, some discrepancies are visible. To the south-west of the cardo, the colonia seems, indeed, perfectly symmetrical: the insulae are absolutely square and the corners where the streets intersect are all right-angled. To the north-east of the cardo, however, such insulae are less commonplace: except for the insulae 24, 25 (Forum), 26 (Capitol) and 27, all insulae are rectangular or irregular. These irregularities are caused by the following factors: firstly, the
city wall between Vetera-Tor and the amphitheatre shows a slight deviation in relation to the city wall south-west of Vetera-Tor; secondly, the street between the insulae 35 and 40 (amphitheatre) runs at a diagonal; thirdly, the Rhine bank also runs diagonally in relation to the cardo; so inevitably, sharp and obtuse corners were created; and fourthly, in the northern region between the insulae 22, 23, 29 and 30, there were also streets running diagonally. What is the reason for such irregularities in this colonia, which was otherwise designed as a complete entity?

The reason is the pre-colonial infrastructure. During the 1st century AD a civilian settlement arose to the north-west of the castellum Vetera I (vicus).26 Excavations inside the colonia have shown that this vicus consisted of at least two streets: the limes-road itself, running north-west towards the castellum Burginatium, was situated more to the south-west, showing a slight bend inside the colonial insulae 19, 20 and 21; and a second road running roughly parallel to it, closer to the Rhine. For the construction of the colonia this street was retained; it became the street between the insulae 31, 36, 32, 37, 33, 38, 34, 39, 35 and 40. Other pre-colonial streets which were retained are situated between the insulae 29 and 30; between 24, 25, 31 and 32 and between 39 and 40. Strikingly, the main thoroughfare, the limes-road, was not retained; immediately north-west of Vetera-Tor, this thoroughfare was straightened out as the new cardo, redirected towards the north-east and the former thoroughfare was built over by the new insulae. Road sections in insulae 37 and 38 were also occupied by insulae.

However, it is still unclear why the pre-colonial streets in the north-east part of the colonia were retained. It should have been easy to break up or straighten them out, which was done with the original limes-road. A possible explanation will be discussed below.

Traffic circulation in Xanten

Just as in Pompeii, the streets in Xanten occupy a considerable part of the city area. In Xanten, however, the streets are extremely wide: a width of 10-12 metres, excluding the roofed sidewalks, which have a width of about 4 metres. The harbour gates, however, were single gates suitable for one-way traffic; the imposing land gates were double gates or three-

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passage gates.²⁷ Did the planners and architects of Xanten intend to avoid any type of traffic congestion and the inconvenience of one-way traffic? In the case of Xanten, there was enough space to construct a city with all the usual facilities and services, without the discomfort of an Altstadt which was the case in Pompeii. Nevertheless, the pre-colonial infrastructure was, at least partly, retained and made to conform. It is still unclear why the limes-road was not retained but built over; straightening it out was perhaps done for aesthetic reasons²⁸ and maybe only a few buildings had to be demolished.²⁹

Obtuse corners in Xanten

The soil structure of Xanten was quite different to that of Pompeii: not volcanic soil, but river clay. Xanten was not suddenly destroyed by a catastrophe, but abandoned in Late Antiquity. So wheel ruts and worn down stepping-stones and pavements, indicating the flow of the traffic and the direction it took, are not found here.²⁰ Looking at the widths of the streets – not only suitable for two-way traffic, but also wide enough for parking carts and stabling animals – traffic congestion was not really a problem and driving seems to have been permitted everywhere. Inside the city, parallel to the city wall, ran a street which could also function as a ring road. This ring road, following the pomerium, was interrupted twice: at the amphitheatre area and at the ‘Hafentempel’ (Harbour Temple).

Traffic entering from the Rhine side – probably mainly cargo traffic – had to go one way, however: the gates along the quays were all narrow single gates, suitable for only one vehicle or animal to pass through. After passing through the gates one could turn right going round an obtuse corner, or left, a sharp corner. While excavating and researching the so-called ‘Kleine Hafentor’ (Small Harbour Gate), archaeologists discovered that the northern cornerstone on the city side of the gate – on the obtuse corner – shows the same wear as the worn cornerstones in Pompeii. The

²⁷ The reconstructed Burginatium Tor was a double gate; the south-western Maas Tor was a three-passage gate. The number of passages of the south-eastern Vetera Tor is unknown; Van Tilburg 2008:141-42.
²⁸ The change of infrastructure for aesthetic and embellishment purposes was not unknown; e.g. the reconstruction of Rome to Neropolis after the Great Fire in AD 64.
²⁹ Traces of buildings which had to be demolished for the straightening of the limes-road are found between the insulae 15 and 22, and between 16 and 23; Heimberg & Rieche 1998:29.
³⁰ Stepping-stones were scarce in antiquity; Kaiser 2011a:50.
corresponding southern cornerstone of this gate does not show any wear at all. So the evidence shows that in the traffic-friendly Xanten, too – in the case of one-way traffic – drivers were following fixed routes by using obtuse corners (fig. 7).

Figure 7: Xanten, Kleine Hafentor, with worn cornerstone.  
Photo C. van Tilburg

Is there more evidence of the use of obtuse corners? It has been mentioned above that certain parts of the pre-colonial settlement were retained after the founding of the colonia, around AD 100. After the creation of the new cardo, a second north-west south-east route could be constructed in this way, where traffic could make use of obtuse corners (fig. 8). So the cardo and decumanus both had an alternative route with obtuse corners.
What was the advantage of such an alternative route? Ring roads around the cities were unknown, so through traffic was forced to go through the gates when crossing a city. To avoid the busy centre, an alternative route could relieve this inconvenience. In his recent PhD thesis concerning 'Forum Hadriani' (Voorburg, today a suburb of The Hague) Buijtendorp argues that in this small town there were two decumani connecting the gates. The most northerly was the widest, functioning as a thoroughfare. The most southerly, situated along the Forum, was a shopping avenue. If the wide, northerly decumanus was connected with the east gate (gate 5), the situation should have been the same as it was in Xanten, although the (obtuse) splitting of the traffic here in Voorburg would have already taken place outside the city walls instead of within (as in Xanten). The extreme width of the northerly decumanus, partly paved, made it possible to drive herds through the city, thus relieving the southerly decumanus which was more suitable for pedestrians (and able to be narrowed easily). More examples of parallel routes are to be found in

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Buijtendorp 2010:350, fig. 4.2.
Tongeren (Belgium), Avenches and Oberwinterthur (Switzerland). In Voorburg only the centre of the northerly *decumanus* was paved. It was also possible to walk over the unpaved sections, which facilitated parking and stabling generously. Such a situation has also been discovered in Cologne.33

**Traffic circulation and the forum**

Usually, the forum was located at the intersection of *cardo* and *decumanus*. A forum was square or rectangular, surrounded by colonnades or walls, and always strictly forbidden to wheeled traffic (fig. 9).34 This forum was often, but not always, situated in the centre of the city: in Pompeii, Cologne and Colchester, the forum was located on the periphery.

![Figure 9: Pompeii, forum with barricade. Giuntoli 1989:35](image)

In contrast to the planned cities in northern Europe, in Pompeii wheeled traffic could not drive around the Forum. Traffic with the Forum as destination (there was a lot of building-traffic for the rebuilding of the Forum after the earthquake of AD 62) was forced to use several culs-de-

33 Buijtendorp 2010:640.
34 In the first instance, however, the Forum in Ostia (a town more suitable for wheeled traffic than Pompeii) was open for cart traffic, but blocked in a later period, Kaiser 2011a:131-32.
sac, finishing as dead ends against the Forum area. Recent research has provided evidence that for the reconstruction of the Forum new buildings were erected and streets to the Forum, like the Vicolo del Balcone Pensile, were narrowed. The one and only street running along the Forum was the short road section south of the Terme del Foro. Wheeled traffic was completely closed off here. The imperial fora in Rome show the same design.

In coloniae like Xanten, Cologne and Colchester, their fora were also closed off, but surrounded by streets suitable for wheeled traffic. There were two types of traffic design. Firstly, the intersection of *cardo* and *decumanus* was a single intersection, from where traffic could drive in four directions. The Forum was situated beside this intersection. An example is Xanten (fig. 10). Secondly, there was no real intersection between *cardo* and *decumanus*. One main route ran along the Forum; the other partly encircled it by means of a zigzag route. An example of this is Cologne (fig. 11).

![Figure 10: Xanten, plan with intersection. Image C. van Tilburg](image)

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35 For the reconstruction of the Forum and the development of the infrastructure see Poehler 2011a:149-63; the situation of the Vicolo del Balcone Pensile is mentioned on p. 153. See also Kaiser 2011a:97.

36 Lanciani 1990:fig. 22.
Both Cologne and Xanten were designed as a complete entity, so there was no question here of an alteration in design and traffic circulation. Both designs have advantages and disadvantages. The advantage of the Xanten model was that traffic could cross the city via the shortest, straightest route. The disadvantage was that this design caused a dangerous intersection – even more dangerous in the absence of traffic signs or officials. The Cologne model had the advantage that travellers were forced to reduce their speed and the local authorities could then create an imposing view of the Forum for passing travellers to admire. This was not the case in a city such as Caerwent (south-west Britain), where the zigzag route encircled the entire Forum and the approach road did not lead straight to the axis of the Forum, as in Cologne.

In the case of the Cologne model there was one zigzag route; the other route was straight. In Cologne, the *decumanus* was the zigzag route and the *cardo* the straight one; contrastingly, in Caerwent the *cardo* was the zigzag route and the *decumanus* the straight one.

Another *colonia*, Trier, was not designed as an entity. Up until the end of the 2nd century AD it was an open city. Due to the instability caused by the first Germanic invasions and the struggle between Pescennius Niger
and Clodius Albinus in 193, the local authority decided to construct city
calls and gates. The location of the gates obviously determined the course
of the north-south and east-west routes. The route of the decumanus was
already fixed: this formed the connection between the bridge over the
Mosel river and the Forum. The route of the cardo could, however, be
modified: the city authorities could either place the southern gate (facing
Porta Nigra, the northern gate) as a direct continuation of the cardo
coming from Porta Nigra, creating an intersection as in the Xanten model,
or construct the southern gate elsewhere, creating a zigzag route, as in the
Cologne model. The city authorities chose the Cologne model; the Forum
was partially, and not entirely, encircled (fig. 12). An argument for the city
authorities to choose the Cologne model could have been the policy of
reducing speed – traffic accidents also took place in antiquity, so laws were
established37 – but another factor could have been the existing economic
importance of the street running from the Forum to the south-west.

Figure 12: Trier, plan with forum route. Image C. van Tilburg

37 E.g. the Lex Julia Municipalis or Tabula Heracleensis (CIL I2 593, 56-67) and
3.259-60: quid superest de corporibus? quis membra, quis ossa invent? obtritum
volgi perit omne cadaver. Accidents with children: Laes 2004:163; Drexhage
1986:19; 22; Robert 1955:280-82.
In some cities it is unclear whether the Xanten or the Cologne model was chosen. It is assumed that Voorburg followed the Xanten model, with no zigzag route (fig. 13a). However, this is not certain, because we do not know the number of gates in the east wall. Buijtendorp argues that the east wall probably had gates which corresponded with the gates which have been excavated in the west wall. So we can logically expect that there must have been a gate in the east wall, connecting with the wide thoroughfare decumanus (gate 5). However, it is not certain that there was a gate connecting the more southerly decumanus (gate 6); it is also possible that entering traffic passed through a gate more to the south, which in this case would have been a main gate (gate 7). In that case, a zigzag route could have been possible in Voorburg (fig. 13b), although the Xanten model looks more likely. A parallel route in a city with a zigzag route has also been found in Cologne itself; here, too, it was the decumanus (fig. 14).

Figure 13a: Voorburg, plan with intersection and gate numbers. Image C. van Tilburg

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38 Buijtendorp 2010:350, fig. 4.2.
39 Wolff 2003:fig. 1.
Figure 13b: Voorburg, plan with zigzag, parallel route and gate numbers.
Image C. van Tilburg

Figure 14: Cologne, plan with zigzag and parallel route.
Image C. van Tilburg
Summary and conclusion

All through history, there has hardly been any research into traffic circulation and blocked arterial roads in the ancient Roman world. Only in recent years have eroded ruts and curb stones in Pompeii been more meticulously investigated and they give us a picture of a dynamic flow of traffic. Some streets were under reconstruction at the time of the Vesuvius eruption; other streets show deep ruts. The city authorities could block or unblock streets and alter routes at will. In many cases traffic was forced to follow fixed routes, with obtuse rather than sharp corners being preferred.

It also seems that in cities with enough room for infrastructure, like Xanten, certain fixed routes were common; also here, there was a preference for obtuse corners. Unfortunately, it is unclear whether streets were closed or opened by the city authorities; the clay soil does not permit the indication of routes by showing evidence of ruts. However, the worn northern cornerstone of ‘Kleine Hafentor’ clearly proves that in the case of one-way streets, traffic passing the single harbour gates preferred obtuse corners. The local authorities probably encouraged this traffic direction.

The city government could also stimulate the use of certain traffic routes by the positioning of gates to correspond to the entry and exit roads. One could choose an intersection model or a zigzag route model, encircling the forum either completely or partially. In the latter case, one zigzag route was enough; up to now a city with two zigzag routes has not been found.

Bibliography


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