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Mapping a Blank Spot and Making Empty Spaces Geographic and Cartographic Ontology in Italian Topographic Mapping of the Southern Libyan Desert in the 1930s

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Abstract This study explores the ontological assumptions of mapping as active processes, rather than passive representations and discusses the need for pragmatic guidelines in map-making, as maps only acquire meaning through their users' minds and bodies. The paper presents historical examples of Italian colonial topographic mapping of the southern Libyan Desert during the 1930s. It emphasizes the interconnected histories of geographical exploration, social and cultural contexts, and technical practices. The paper argues that the 'empty spaces' on maps reflect intentional choices made by cartographers, not insufficient data. The performative nature and diverse sociocultural conditions of maps need to be considered to understand their meaning and use.

Keywords Geographic ontology. Mapping processes. Italian colonial cartography. Topographic mapping. Libyan Desert. Blank spot.

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1 Introduction: Cartographic and Geographic Ontology

The history of cartography started in a period when maps were considered representations of positive knowledge, images of the calculable geographic space. In the 1990s the accepted view held by 'internalist' historians of cartography was challenged by the socio-cultural criticism represented by Brian Harley and his many followers. The new approach, deconstruction questioned the very ontological assumptions of cartography, and various researchers demonstrated the fundamental problems with true, scientific and neutral representation (Harley 1989). The theoretical basis for new methodologies came outside of the traditional, disciplinary scope of cartography (Eckert 1921): from critical, social and political theories. In the early twenty-first century the epistemological crisis of traditional cartography as a discipline is apparent for both internalists and 'outsiders' if interested in cartographic theory. At the same time, with the enormous pace of technological developments in the social use of spatial information, a new theory on 'mapping', instead of cartography, is more relevant than ever. If the substantial problem is in epistemology research must reach what is beyond it. In contrast to the explanation given by the positivist theory of passive cartographic representation, we can consider mapping as an active process to break out of the cage. Mapping as a process calls for the attention of the situated use and users in the world and focuses on the 'ontologically insecure' meaning of maps (Kitchin, Dodge 2007), created as performative presentations under highly different sociocultural conditions.

While these new approaches offer new vistas for understanding maps as ideological and political discourses, professional and academic cartography and GIS practice are interested in more pragmatic guidelines, the ways that make maps work in common practice. Maps can work because of their existence, either drawn or printed on paper or displayed on the screen of the mobile phone. However, maps as things in the external world become maps once humans use them. Without their users, they are just physical objects – or words, gestures and movements with different meanings. When they are used they work together with the minds of users, who also have bodies surrounded by a physical environment, including the map itself. These are highly complex processes, but we do not need maps when our mental capacities are sufficient. At some point in the long history of human evolution, millennia earlier, we innovated external tools to help us solve problems with high complexity. The powerful tool we use to solve complex spatial problems is what we call a 'map'. Maps are powerful as they exist, and the characteristic patterns of their use are what we can call mapping modes.

I could talk about ontology to Brian Harley in 1990 when he invited me to Milwaukee to do historical research in the American

Geographical Society's Library. This personal remark is included here to propose that, although fascinated with revealing cartographic ideology and masked meaning at that time, Harely was interested in ontology and could see its prospect. Ontology in its strict sense is about 'being', the world in itself, as if we could see it from outside. This is not what we can learn from the experience of the 'beings' in the world. Elden (2001), who compared the philosophical ontologies of Heidegger and Foucault to show their affinity, stressed the distinction, between "ontologic" and "ontic" knowledge. This approach was followed in critical cartography, where Crampton emphasized the difference regarding the conflicting views resulting in "cartographic anxiety" and also emphasized the political role of technology in mapping and GIS (Crampton 2010). In this paper, that ontic knowledge, the knowledge about the properties of entities, however, is also considered part of social ontology. Geographic ontology is about the existence of entities in geographic space, while cartographic ontology is about the graphic entities, signs, lines and areas, existing in the mapping space. The common understanding that a map is 'an image or representation of a part of the earth's surface as it is seen from above' offers a false explanation of the real nature of mapping. The oversimplified and misleading concept of 'representation' becomes apparent once we put European cartography into an extremely different context.

The aim of this study, when presenting historical examples of Italian topographic mapping of the Lybian Desert in the 1930s, is to explore actual mapping processes and make apparent some relations between different mapping modes. To make some of these, highly diverse and sophisticated, technical or socio-cultural processes comprehendible for scholarly readership first the broader social and cultural-technical contexts are introduced. We emphasize the interrelated histories of geographical exploration and mapping, but this paper is limited to some observations regarding the colonial cartography specified above. The conceptual problems of colonial cartography are noted by the authors in the recent volume edited by Lobo-Guerrero et. al (2021), which is organized around the connectivity problem of European colonial mapping practices. This paper, although offers a similar narrative, is more limited to technical questions and takes an ontological approach. Although to demonstrate mapping ontology at work, we are interested in a particular colonial mapping practised under extreme natural and socio-historical conditions, with the diverse interrelations of individuals and institutions (colonial cartographers and mapping agencies), who were all involved in the mapping of the desert. These contextual frameworks are sketched below to enable us to study the historical interrelation and processes between geographic and cartographic ontologies.

Researchers rarely explore this field, especially not in its historical context, although connecting domains and ontologies is substantial for the understanding of mapping processes. A map, a thing in the world, functions as a map in the interactions with humans and environments. Map makers, readers, but also sellers, librarians, the collectors use maps in different ways in various emergent situations. The topic of our paper, however, is not to present any general theory on mapping processes, but the scope of our investigation is limited to some aspects of the field that may be called 'application ontology'. In our historical case study, we try to reveal some of the mental, cognitive or physical, graphic relations between entities of two domain ontologies: geography and 'cartography'. Using these relations we try to interpret a historical mapping task, the re-presentation of the Kufra desert region by a colonial mapping institute on Italian topographic maps in the 1930s.

The substantial problem of cartographic representation theory is demonstrated by the 'empty' spaces on maps: large patches of the topographic sheets with graphic elements with no locational meaning. Blank spaces on modern maps can be problematic for different reasons. Franco Farinelli, for example, proposed that the empty space created by cartography was a condition of global capitalism (Farinelli 2009). The examples demonstrating the paradox of cartographic reason, e.g. Bellman's blank map in Lewis Carroll's satire, are often cited but rarely scrutinized as indicators of ontological questions (Török 2017).

The issue is illustrated here in more detail by historical examples: Italian colonial and military cartographers transformed expedition route maps into territorial cartography to create content for the otherwise blank topographic map sheets. This compilation work contradicted the topographic paradigm. The result was not a more accurate and detailed map of the desert – how one would expect from the cartographic context, masking the procedure. Although the notion of 'desert' means an abandoned place, left by humans with no water, vegetation or animal life, it is certainly not 'nothing'. A related, but contrasting concept is the word 'oasis', an occasional fertile spot with a spring and a dwelling space for humans, is an indicator of sporadic human presence in the wasteland. We argue that the main reason for the 'emptiness' of maps was not caused by a lack of survey and data or information collected. The printed, official topographic maps of *Libia* were created with empty spaces for ontological reasons.

2 Expanding Borders: "Libia Italiana"

Why Italian military cartographers surveyed and mapped the Western part of a huge region, historically called the Libyan Desert – and why mainly British cartographers did the same job on the Eastern half of it is a question we should answer first. And what makes these cartographic processes, at first sight, a common, early twentieth-century topographic survey and mapping significant for our ontological investigations? The short answer is that both the social-historical and geographic contexts make our historical overview especially suitable to study the relations between geographic and cartographic entities in mapping operations, both perceptual and cognitive and technical, and try to explain the real nature of modern 'cartography'.

As to the social-historical environment, our spatio-temporal context, the answer can be found in modern colonialism, a product of imperialism, in our case in the history of modern Italy. Unified Italy, as a relatively late-created state, a European middle power arrived too late on the scene to seize overseas territories, while European maritime powers could build extensive colonial empires at a global scale. By the late nineteenth century, at the infamous 1884 Berlin conference, 'the scramble for Africa' was turned into geopolitical negotiations and international treaties to divide the 'Black continent' among the participants. After occupying Eritrea in East Africa and expressing interest in the much closer and more important North African region, Italy had a second chance in 1911, when Italian troops landed and invaded the major ports of *Tripolitania* and *Cirenaica*. In the following year control of former Ottoman-Turkish territories was taken over by colonizing Italy.

At the beginning the occupied territory, the province called later "Italian Lybia", was a few harbour cities and a rather narrow, but fertile coastal strip along the Mediterranean Sea. The territory gradually expanded after Britain and France ceded further continental regions. Italian colonial administration could not rule the vast, southern desert region, because of fierce resistance organized and led by the Muslim religious order, the *Senussia*. This fundamentalist and purist religious order retreated to the remote Kufra oasis and kept its power in the deep desert, which remained closed to Europeans until the 1920s. The hostile *Senussia* remained the centre of Libyan resistance and presented a permanent threat to the colonial administration. In 1931 the Italian colonial army occupied Kufra and gained full control of the southern region.

3 Modern Cartography: A Myth of Accurate Representation

Modern 'cartography' was born in the European Enlightenment as a paradigm of a rational and positive empirical system of creating immense archives of knowledge. The extensive territorial survey of France, a centralized, absolutist monarchy started in the late seventeenth century. Based on astronomical measurements by Cassini and Picard first, the coastlines of France were calculated and determined in a global, geographic framework. To survey the territory with high precision and detail the entire country was covered by a geometric network of triangles. The triangulated points served as bases for local topographical surveys, including observation and measurements by the military and civilian engineers in the field. The whole procedure of the paradigmatic Cassini survey took more than eighty years. This enterprise was the model for similar, topographic mapping projects. The Napoleonic survey started with the mapping of Egypt (1798-1801) and is a demonstrative example of European 'cartographic' ideals of the Enlightenment. Modern 'cartography', with the normative concept of 'the map', and all the false preconceptions about the nature of mapping reflect this period.

According to Edney's recent book (2019) challenging and refuting the conceptual basis of modern cartography from a historical point of view, what we call 'cartography' is a tempting myth about precise measurements and detailed and accurate maps covering the entire planet Earth and the world beyond. Map making is a huge progress of knowledge and a great success as a human endeavour. However, mapping was never a singular or monolithic enterprise. Realizing the ideal of 'the map', a spatial inventory in a geometric framework, would result in the duplication of the world. The ontological paradox, the contradiction between the 1:1 scale map and true cartographic representation was recognized by Carroll (1893), who playfully suggested an absurd solution: the country as its own map.

This investigation is in line with Edney's theoretical approach, but – instead of challenging that ideal of cartography – we simply look at its working mechanism under specific conditions. For this gentle approach, we use the word 'cartography' in our temporal context as a relevant concept, characterising what was thought about the nature of mapping at that time. The word is a neologism created in the 1820s and became popularized by academic cartography which was born as a discipline only in the early twentieth century (Eckert 1921). This formation period of the cognitive and social structure of the field in the 1920-30s makes the study of contemporary mapping practice relevant. As we would like to demonstrate, the ideal did not work in the way the idealists believed. The logical-epistemological construction of the comprehensive and accurate spatial archive, 'the map' of the world, was not on the agenda of the colonial cartographers.

4 Geographic and Cartographic Ontology

Maps are one of the oldest and most effective tools for storing and displaying geographical information in both cartography and geoinformatics. However, the historical and social determinants of the ontology of cartographic objects have only come to the fore with the paradigm shift of the last decades, mainly in the context of the creation of a more rigorously constructed map model, as required by digital technology. The notion of ontology is not unknown in GIS science or the field of geo-informatics, where it is understood as a set of predefined concepts and entities that form models, representing some features and relations of the real world in a spatial framework. In this approach, an ontology can be a specification written in a formal language. The primary purpose of this domain ontology is to give meaning to concepts, i.e. to describe the semantics necessary to transfer and share knowledge contents, or to create new knowledge from different data contents. All these functions are relevant for any geo-informatics applications, this is why the research and development of geo-ontologies intensified in the field of GIS science in the 1990s.

Compared to this notion of domain ontology, widespread in modern information technology, the term is also used in metaphysics, in philosophy in a different sense. Here ontology means a theory of being ('of what is'), and it is a general theory that deals with the fundamental questions of existence ('being as such').

In the domain of geographical science, the term geographic ontology describes not only the geographic space itself but also its entities, since geographic entities are in most cases also the bases for further conceptual categorization. This is the approach of the 'external' view, where space is the container, a geometric framework that contains the geographic objects. In the contrasting 'internal' view of geographic space is constructed by spatio-temporal geographic entities. From the perspective of evolutionary psychology, Coucleis (1986) suggested a structural approach to describe different spaces in human experience from perceptual to the abstract concept of Euclidean space.

Geographical objects are non-manipulable, large-scale entities in geographic space, which require the study of topological and part-whole relationships (mereology) to describe them (Smith, Mark 1998). Objects in geographical ontology are highly culture-dependent, i.e. their symbolic description is highly variable in different regions of the world. A particularly demonstrative problem is the question of the cartographic representation of geographical objects in a huge, non-European territory such as the emptiness called the Libyan Desert. As late as the 1920s, in the absence of reliable knowledge of the interior, only hypothetical maps and vague geographical concepts

existed. The concept of a 'boundary', for example, is highly abstract: in topological terms, it is a geometric line with no width. On maps line symbols are drawn to mark different boundaries (Smith 1995). In geographical reality, however, the appearance of a border can be very varied: the concept of the former 'iron curtain' in East-Central Europe, and the similar constructions in many other parts of the world, illustrate the complexity of an asymmetric relation realized in defence structures. Disputed international borders are also examples of disambiguates and controversies regarding the interpretation of the concept, and in particular its spatial location.

5 International Borders in the Sand

From a cartographic point of view, international borders are highly important for any territorial mapping projects. Boundary lines, and linear 'symbols' are the highest-order political demarcation lines that define the actual territory, and the systematic topographical survey and mapping expand to the entire region inside the borders. Topographic mapping results in a series of medium-scale map sheets, covering the territory. However, borders may not follow the map's neat lines, so the sheets cover a part of the neighbouring territory as well. Mapmakers usually do not leave the parts of the topographic maps beyond the international borders empty, but they fill it with information about the territory of another, not rarely rival power. These cartographic conditions can create a zone along the international boundaries, which are mapped from two different perspectives. It would be instructive to compare such maps and examine these countermappings, but in this paper, we study the view from the Italian side.

Egypt was occupied by the British colonial army in 1882 and became a British protectorate in 1914 and a nominally independent state in 1922. The neighbouring Libya was occupied by Italy from 1911. The border treaty between Egypt, under the British protectorate, and Italy was concluded in 1925. The international border, starting from the Mediterranean, south of Sollum, was surveyed and delimited in 1926-27 in two periods. In addition to the dozens of astronomical points, the points of the Egyptian triangulation network were also used at the coast (Governo della Cirenaica 1927). The report of the border demarcation committee included a map representing 178 numbered border markers, and the copy examined (no. 25) was signed by all the surveyors (Commissione 1927).

The border demarcation resulted in actual boundary markers, and iron poles, which made the boundary line visible in the field. Once these were erected, the boundary had physical markers, while it still existed as a 'fiat' boundary in the treaty. The boundary markers and also the other landforms identified during the survey (e.g. "Williams

Pass") and the triangulation points became important landmarks in the desert. These man-made landmarks were also marked on detailed topographic maps. However, the objects did not mark the exact boundaries. Further away from the coast, in the desert area near Williams Pass, a six-hundred-metre baseline was measured and then graphically triangulated to latitude 29°15' N. Both parties used a measuring table and a telescopic ruler for the topographic survey at a scale of 1:100,000. During the work, temporary boundary markers were placed according to terrain conditions and visibility requirements, up to 150 m from the theoretical boundary, the meridian line.

6 Desert: Object or Field

The process of topographical map-making of the south-eastern part of Italian *Libia*, the region around the Kufra oasis group is described below, and the historic cartographic material, demonstrating the process is examined below. The case study, we hope, would reveal the cartographic creation of an international boundary line between *Libia*, an Italian colony, and Egypt under British protectorate. At the same time, this significant element on the maps challenges the common belief that maps represent objects in the physical world.

If we explore the issue of borders fundamental problems of geographical ontology become apparent. International borders – and other political or administrative borders – are abstract or physical entities, just one set of concepts which may not be visible or measurable in the field. The mapmaker's problem is how to describe the terrain itself with graphic marks on the map so that they correspond to the characteristic features of the landscape. These features are usually emerging entities, visible from a large distance, so are easily identifiable and serve human navigation as landmarks. Nevertheless, although these vertically 'positive' landmark objects, e.g. hills or mountains, are identified as *places* with a geographical name, they become rather fluid at a closer look, once we try to define or delimit their spatial extent.

What is a hill for the surveyor can be a mountain for local people, as the famous movie (*The Englishman Who Went Up a Hill But Came Down a Mountain*, 1995) demonstrated. But the real problem is not just categorization here, which could be solved by some qualitative method, e.g. establishing a height limit for mountains. The real problem in geography is to tell what the hill as an object and as a *field* is, that is to be able to tell what part of the physical environment belongs to the category of the concept. What seemed to have been an object, when looked more closely, is a field…

7 Navigating the Seas of Sand

7.1 The Perception and Cognition of the 'Nothing'

> In the absence of any official definition, it is useful to consider the dividing line in the west as the belt of high ground Fezzan-Tibesti-Ennedi and to limit the term Sahara to the French territory in the west. According to this description, then, the Libyan Desert covers one huge unbroken tract of true desert stretching from the foot of the high ground in the west to the River Nile in the east, a distance varying from 1100 miles in the north to 600 miles in the south. The southern boundary may be taken as the northern limit of annual summer rainfall, about lat. 18° N., so that the desert extends for about 1000 miles from north to south. (Bagnold 1933, 103)

The Libyan Desert covers the Eastern part of the Sahara in North Africa. This is a hyper-arid region in the world, which excludes the possibility of permanent water flows, occasional rains occur and can result in a short-lived water world with abundant vegetation and animal life. But these are exceptional cases because human life in the vast region is present in the oases where water is available. These are green spots in the huge inhabited desert.

In the Libyan Desert vast areas are sand sheets or covered by endless chains of dunes (Kádár 1934). The most remarkable region is the Great Sand Sea, which is filled with parallel chains of whaleback dunes, sometimes more than 100 meters high. This formidable landscape is not an impenetrable obstacle for the European traveller: the 1873-74 Rohlfs expedition crossed the region first to reach the oasis Siwa in Egypt (Rohlfs 1875). For the light automobiles in the 1920s and experienced drivers hose huge dunes caused little practical problem.

All those humans, natives and European explorers alike, who would travel in the desert reported their subjective feelings about the difficulties of navigation in the wasteland. The major problem is not only limited visibility but the limited chance to see anything characteristic of the environment. Although the morphology of desert areas may be quite rugged, as is the case with the rock surfaces, rock and gravel-covered terrain are difficult to find the way without some distant landmark. The problem of desert navigation was the landscape itself, which is unanimously mentioned as dull and monotonous by both natives and Europeans. In this geographical environment, human senses, especially vision were of very little use, but the lack of features and the identification of characteristic objects resulted in problems. Of course, native tribes had more articulated desert ontologies from European, which is reflected in their language. But

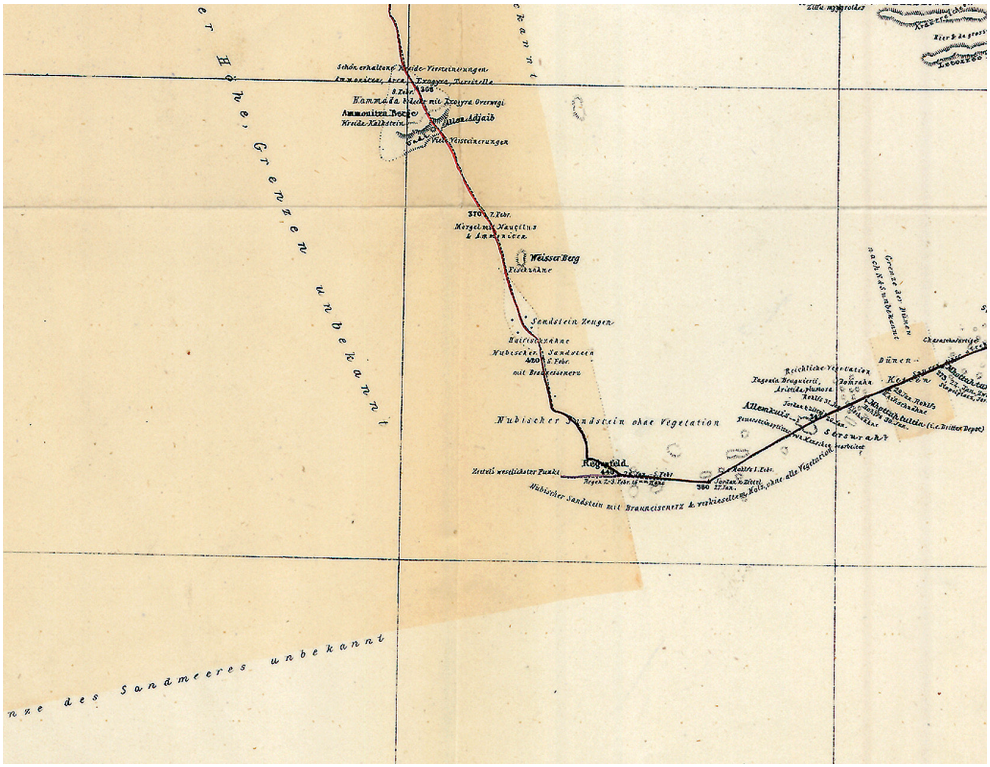

Figure 1 'Regenfeld': the turning point of Rohlfs' 1873-74 expedition in the Libyan Desert. Detail of the expedition's route map by Jordan in Rohlfs 1875

actual navigation in the deep desert remained dangerous for most of them. After the Italian occupation of Kufra (1931), for example, groups of Senussi refugees who wanted to reach Dachla in Egypt were lost in the desert. Women and children died before some were found by Clayton's expedition and many was saved by a rescue team from Dakhla (Almásy 1935).

According to Siegel and White (1975), large-scale human spatial cognition is a developing system, including spatial knowledge of different levels. They proposed to classify knowledge into the categories of landmark, route and survey knowledge. The first level includes the knowledge of landmarks, the location and characteristics of objects in the environment. The specific problem of the desert environment is the scarcity of landmarks to be observed and memorized for the navigator. The perceptually poor space, where the identification of individual places is difficult, causes a cognitive disadvantage. At a semantic level, this is apparent from the geographic names like

"Great Sand Sea", which is a metaphorical proposition. It suggests that the chains of dunes are similar to waves on the surface of an ocean. Their number is infinite and they are moving and changing, just like drifting sand at different scales from ripples to vast dunes. While it is difficult to identify objects, the desert may be considered a field entity. In this case, the problem we encounter is to find its natural borders in the physical world.

Land and water are qualitatively very different geographic features in the field, but defining fluid objects is a challenge in physical ontology. Deserts may also considered fluid, so their geographic ontology is similar to the water-covered surfaces. The cartography of these categories, from ponds to oceans, is very peculiar because these cases may violate the rule that general maps represent objects on the solid surface of the earth in the plane. The sand desert and the sea are considered similar, so it is not surprising that in many respects desert cartography is similar to charting the seas. How the sea chart does not depict water a desert map does not show the actual grains of sand. Anyhow, the desert is something hard to map.

The cartographer is interested in well-defined, large-size and permanent objects. On European maps of the region, one can not find the common water flows, indicators of fluvial erosion, or the major power of landscape morphology at medium latitudes. On the other hand, dry riverbeds, *and wadis*, especially on the elevated surface are marked as they serve as landmarks for orientation. The ontological problem in cartography is the graphic representation of a river without water. The spatial extension of these linear objects depends on their state, they are narrow valleys in the mountains but after heavy rainfalls, they stretch deep into the desert. This is a problem, which is very similar to the more general issues of the ontology of fluid objects (Hayes 1985).

7.2 Naïve Geography of Experts

The European explorers and surveyors worked in unfamiliar environments with special geographic conditions. Although they were all trained in geography and other disciplines, academic scientific knowledge was unsuitable for mapping projects in the desert. This is why contributors to European, colonial mapping enterprises, who were certainly experts in their fields in their own geographic and cultural environment, became novice observers. The conceptual system they possessed included only a few concepts that they could apply in their practice.

Naïve geography is the field of common sense, intrinsic geography: what people think of geography in their environment. In different parts of the world, people think highly differently about their

surrounding landscape, a key concept in this approach suggested by Egenhofer and Mark (1995). We mention the peculiarities of desert landscape below, but here we mention an element, which is highly relevant for our study. This is what the authors call "Maps are more real than experience" and they explain that the key issue here is the higher geometric precision of maps over the mental calculations. This is certainly the effect of the cartographic ideal (Edney 2019), and this is why the study of the maps of the region is important for ontological investigation. It is a well-known phenomenon, that once something appears on the map it has its existence, regardless of its actual ontological status. There are many examples from map history, from mythical lands to never-existing islands. Below we mention a desert myth; the ancient tale of the lost oasis, Zerzura, whose location and existence are still contested.

Words for native languages, mostly Arabic, were used as more expressive than European concepts. When looking at the explorer's maps below we can frequently find words like *wadi* or *djebel* instead of valley or mountain. On the Italian topographic maps, we can find hybrid geographical names like "Piccolo Gebél" at the end of the dune chain north of Uweinat. However, the full meaning of those words was never considered as that small hill and the almost 2000 meter-high Uweinat massive were both called "Gebel" on the same map sheet…

Regarding the temporal characteristics of geographic objects or fields, they are relatively stable. More precisely, for the human observers they appear as very large, long-term structural elements of the configuration of geographic space. The relatively permanent existence and spatial stability, however, illuminates another issue, the temporal aspect of geographic ontology. In recent years this question became practically important to develop a new GIS technology, where modelling spatio-temporal information is a key element. Traditional cartography produced printed maps, interpreted as snapshots, temporal sections demonstrating the co-existence of objects. This approach corresponded to the ideal of modern cartography, although everybody knew that any survey or data collection took time. In other words, spatial data is always temporally heterogeneous. If one considers the extensive surveys of larger countries it is clear that map objects on the same sheet may be separated by decades.

8 Early Explorers of the Libyan Desert

The geographical exploration history of the Libyan Desert by Europeans goes back to the eighteenth century, but due to the climate and terrain conditions and the unfavourable socio-political situation was completed only in the twentieth century (Negro 1991; Vivian 2000). The most important cartographic premises were undoubtedly the

Napoleonic survey and modern mapping of Egypt. This work was carried out under the supervision of the French geographer, Pierre Jacotin in 1798-1801 (Godlewska 1988). However, the Napoleonic survey focused on the Nile Valley and did not include the majority of desert areas. To depict some of the desert areas, the French engineers used earlier sources, especially the map enclosed in the travelogue of the Englishman George Browne or the one by German Friedrich Horneman.

8.1 Gerhard Rohlfs' Route (1873-74)

The 1873-74 expedition led by the German Gerhard Rohlfs was the first experiment to explore the interior of the desert. Beginning the journey from Dachla Oasis in Egypt Rohlf's plan was to reach Kufra in Libya. At some point on the way towards the target in the southwest, he suddenly headed northwest and marched to Siwa in Egypt. His large caravan was the first to cross the unexplored Great Sand Sea, but the project was not accomplished until 1879 when Rohlfs reached the Libyan oasis from Tripoli.

The route of the expedition was depicted on the map constructed based on astronomical determination of positions by Wilhelm Jordan (Jordan 1875). The map of the Rohlfs expedition became a model for all later explorers working in the region, and it was also used as a source by many atlas publishers. The scale of the map enclosed in the book published by Rohlfs (1875) was 1:1,300,000 and it represented the main route of the expedition, the separate routes of its members, as well as the routes of some earlier explorers. The title emphasized measurements and field observations by Jordan, a leading expert in contemporary geodesy.

This was a route map, so it included information along the navigational traverses and the sections of the journey. Visual observation and measurement were limited to a narrow strip of field along the route. As with all similar route maps, it was a graphic description of the journeys and belonged to the body of texts doing the same with words. The dates on the routes are evidence that the intentional function of Rohlfs' map, a "cartographic text", was storytelling. Expedition route maps were diachronic, cinematic views – not snapshots, providing a simultaneous and comprehensive spatial view according to the cartographic ideal. On the other hand, once temporal points and events were put into the graphic space and connected to the storyline, the route, became visible and represented continuity, showing the route from the beginning to the end. As a new entity created this way, the expedition route was considered a cartographic 'object'. With these preliminary insights in mind now we look at the map itself.

Although it was a map, it is remarkable that the majority of the content along the route is not graphic, but textual notes. These labels

are the expedition's history (e.g. *Zittel's westlichster Punkt*), descriptions of the surface geology (e.g. *Nubisher sandsteine mit Braunesenerz*) or the sparse vegetation (vegetated areas in the oases were coloured green). Inscriptions marking desert landforms mention but one generic form, 'dunes' (*Dünen*), without making any morphological difference. The extensive regions covered by dunes are coloured yellow. The explorers gave German names to some places they would find important or interesting (e.g. *Sandheim*).

Perhaps the name *Regenfeld* ('Rainfield') is one of these telling names, where they experienced rainfall in the desert. This was the turning point of the expedition, as they abandoned the plan to reach the unknown Kufra. Map ontology was a key issue in the decision: the validity of the coordinates of the Siwa Oasis was the main argument of the decision. The scholars trusted more in the scientific framework than any local guide, and after the turning point, Jordan used the map and his instrument and navigated the expedition across the entirely unknown territory to the oasis. In the spirit of Enlightenment, this fact was also emphasized by Jordan (1876, 13) as evidence of the practical application of 'mathematically oriented travel'.

8.2 Hassanein's Lost Oases

After shorter reconnaissance trips significant technical developments made it possible to access the areas by motorcars or aeroplanes that were previously inaccessible. Romantic motifs, especially the legend of the lost oasis, "Zerzura" ("The Zerzura Problem" 1930) also highly motivated explorers, colloquially called "desert fools". After the First World War, research of the inner Libyan Desert was systematically advanced through research trips and expeditions. The peculiar conditions of the Libyan desert turned the story of the discovery of one of the last 'blank spots' into an adventurous novel.

Desert mysteries and romantic motifs significantly stimulated desert exploration in Egypt in the 1920s and 1930s. Still a classic camel caravan, the expedition of the Egyptian diplomat, Achmed Hassanein was a journey around the inner Libyan Desert (Hassanein 1925). Using the routes connecting the oases, Hassanein Bey successfully reached the more or less legendary Kufra oasis from the north in 1922. He continued the journey to the south, explored the mountain oases Archenu and Uweinat and went on to the Sudan. In the 1920s the Egyptian prince, Kemal el Din experimented with motor cars and made a long-range journey into the southern regions, discovering the huge sandstone plateau, "Gilf Kebir".

However military-political interests influenced the results of all expeditions at this time. The account of the expedition of Hassanein Pasha was, published in the National Geographic Magazine in 1924.

Its subtitle suggested not purely scientific interest: "*The Record of a 2,200-Mile Journey of Exploration which Resulted in the Discovery of Two Oases of Strategic Importance on the Southwestern Frontier of Egypt*" (Hassanein 1924). From this time on, desert exploration became more and more military-oriented. Explorers' maps were considered confidential sources of strategic information, especially regarding communication routes and water.

9 Camels and Automobiles

An earlier type of 'romantic' explorer was Harding-King, an Englishman, who, with the support of the Royal Geographical Society in London decided to find the legendary oasis. In Dakhla, the westernmost oasis in Egypt, he observed the migrating birds coming from the southwest and with freshly eaten olives in their stomachs. Based on his experiments, he calculated the distance of this 'olive' oasis and made three attempts to locate it in the desert. In 1911 he reached a point approximately 250 kilometres southwest of the oasis, but his camel caravan had to return because his native guide tampered with his water supplies. To summarize his research findings Harding King published a book (Harding-King 1925) with a non-traditional map. The map he constructed was based not on the survey but on native information. Disguised as an overview map, it was an amalgam of information of highly different reliability, as it was distilled mainly from verbal reports including many lies. In modern terms, it may be considered a 'mental map', constructed by an outsider, a European explorer.

9.1 Bagnold Journeys

The motorized expeditions into the desert from the Egyptian side led by Ralph Bagnold, a British officer represented the new situation and the change in the nature of desert exploration. Using specially equipped Ford automobiles, Major Bagnold, and his companion explored enormous tracts in the Libyan Desert in the early 1930s, but could not find the lost oasis. The map showing the routes of Bagnold's 1929 and 1930 expedition was the best expedition map of the region. "Owing to unforeseen delays in receipt of material" the sheet was published in The Geographical Journal as an appendix, but half a year later than the paper it belonged to (Bagnold 1931, 525). The mapping of the 'blank spot' required unusual cartographic solutions to the problem of graphically depicting nothing important, the desert.

Bagnold's map was filled with information, but these are short

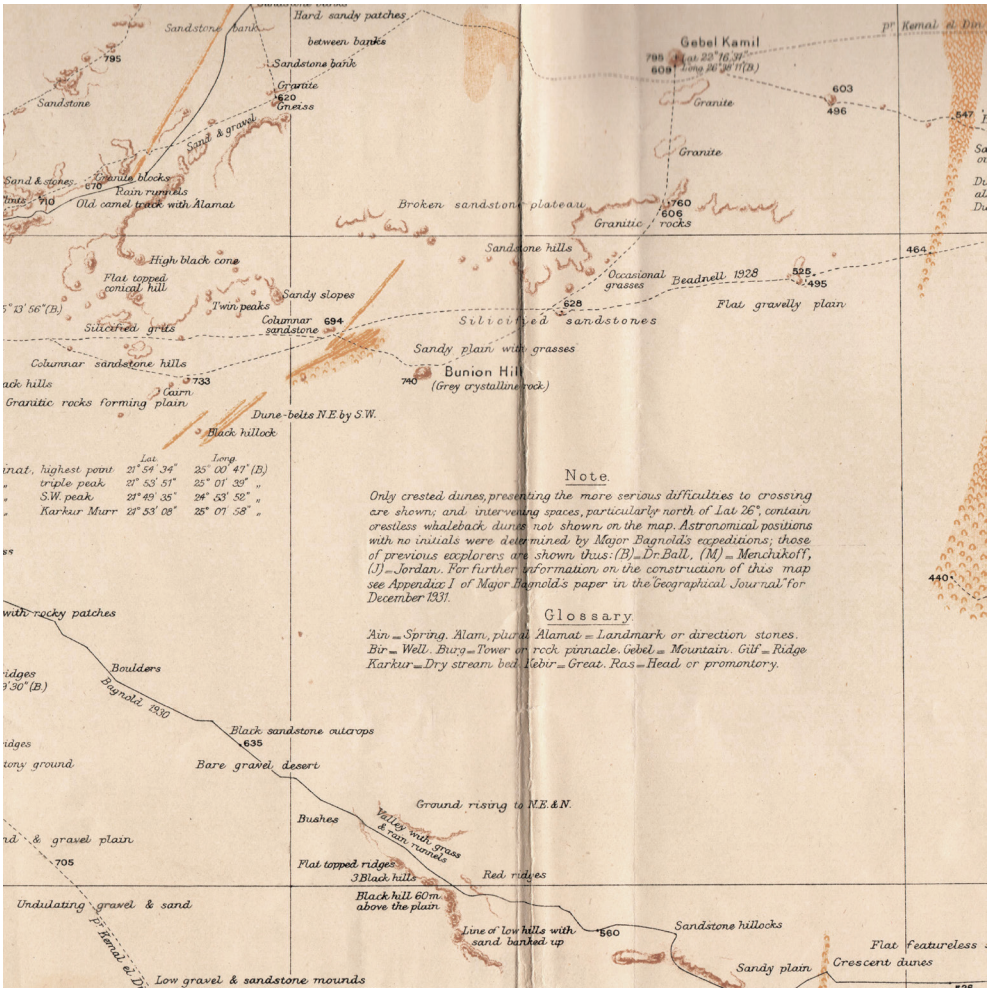

Figure 2 The Gilf Kebir region on Bagnold's expedition map. Detail in Bagnold 1931

remarks and notes regarding surface geology, botany or zoology. These types of information would have been ignored by any compiler of a geographical map on a scale of 1:1 million. Cartographers normally would not depict topographic features such as a "dead camel", apparently a landmark in the field west of Rohlfs' Ammonite Scarp. In lack of suitable conventional signs, the map included textual notes as the graphic language of European geography became insufficient to represent objects like "hawks" or the repeated telling inscription "flat featureless sand plain". The map maker created an illusion: when

placing something non-geographic into the blank spaces of the map the scientific, technical and cultural preconceptions of cartography' ideal suggested to the reader that the territory had been surveyed. The representation of the sand desert illustrates a more intricate effect of mapping. Although some of the areas covered by crested dunes were indicated by generic graphic forms and yellow colour on the map, most of the areas were left empty. A special "Note" on the map explains that dunes are shown only if they cause difficulty for the motorist, a point certainly important for the military. Bagnold's expedition map, based on route survey, included many empty spaces between the known routes, moreover, intentionally left huge desert tracts empty. What to represent when nothing was cartographically important was indeed a serious existential problem.

9.2 Count Almásy, a Hungarian Desert Explorer

The Hungarian László Ede Almásy, the model of the character in the novel and movie *The English Patient*, was born into a noble family (Török 1998). The last Austro-Hungarian explorer showed a passionate interest in automobiles and aircraft since his childhood (Török 2004). In 1926 he drove a Steyr automobile for the first time through Egypt to hunt in the Sudan (Almásy 1928), in 1929 he carried out his first expedition to East Africa, Sudan and Egypt. During this journey, he re-discovered a section of the legendary, ancient caravan route *Darb el Arbain*, the "Path of Forty Days". This experience was a turning point in his activity, as he learned about the legends of the Libyan Desert. In the next few years, he pursued these legends, especially the story about Zerzura, the lost oasis (Almásy 1935; 1939). His companions and 'competitors' were mainly British, who were all loyal to London and served the colonial interest of the empire. The series of long-distance, motorized expeditions led by British Army Major Ralph Bagnold, a member of the "Zerzura Club", started in 1929. The interest in expeditions approaching regions of the Egyptian-Libyan was heightened after the Italian occupation of the Kufra oasis in 1931. The Italian colonial army's operation, carried out with modern military technology and air support, drove some of the Senussis, the inhabitants of the oasis group into the desert, most of whom died of thirst. After the capture of Kufra, topographic mapping of the colony began, carried out by the Uffizio Studi at the Italian colonial headquarters in Bengasi and/or by the Istituto Geografico Militare in Florence.

In April 1932, the Almásy-Clayton expedition came close to the western edge of the Gilf Kebir, a sandstone plateau in the frontier area, when further exploration and return was made very risky by the depletion of reserves. On 27 April, to collect supplies Almásy drove a car to Kufra in Italian territory.

Figure 3 László Almásy with commander Rolle (in the middle) and Italian officers in Kufra (1932)

After completing his mission, he managed to explore two vegetated valleys by plane. In 1933, Almásy's expedition visited Kufra again and, following a native's narrative, found Zarzura's third rain oasis (Almásy 1936; Török 1989). These Almásy-expeditions did not, of course, escape the attention of Italian military intelligence. The expedition maps of the time were an extremely important source of information, so it is understandable that the military and colonial authorities attached great importance to them and sought to obtain them. However, the sketch maps of the Almásy and the other contemporary expeditions were not only important documents for intelligence services, but they were also used in the construction of the Italian colonial topographic map series (Almásy 1997).

10 Italian Military Sketches from Kufra

The name of Almásy as a desert explorer became internationally known after the release of the movie *The English Patient* (Török 2008). The general interest in his achievements in Hungary resulted in a lucky find in the archives of the Military Historical Museum in Budapest. The archivist, who prepared maps for a presentation about the Libyan Desert found a group of Italian maps, both printed and manuscript, which were earlier unnoticed. According to the inventory, these maps were acquired from a private person in 1985, but, unfortunately, more information about the source of the content of the two large folders was not found. This cartographic material

reflects Italian colonial interest before World War II and it consists of mainly printed Italian topographic map sheets, representing Libya and Ethiopia. We could separate a smaller set of the material, which included copies of the manuscript, apparently military map sketches. The manuscript material was created in the 1930s, probably by the same draughtsman working in *Cirenaica*, in Libya. The Budapest material on contemporary, brown-yellowish paper could have been made by some Diazo reproduction method in the lithographic office in Bengasi (Török 2012).

The survival of these maps offers the rare chance to have insights into Italian intelligence and map compilation processes. Although, all the manuscripts were copies of expedition maps, which were published in books and journals, handwritten notes on the verso side of the sheets directly link the material to Kufra. The most important is the handwritten ownership note and signature on one of the maps: *Proprietà Cap. Fabbri*. Cesare Fabbri was the interim commander of Italian Kufra in the absence of Major Ottavio Rolle. Based on this identification we can be pretty sure that the military sketches are related to and might have come from Kufra. Of course, it would be tempting to suggest that they related to Almásy, who visited Kufra in 1932 and 1933 (Almásy 1935), and whose documents and papers hidden in the wall of his Budapest flat were confiscated by the Nazis in 1944, but further evidence for this hypothesis is lacking.

The group of military sketches was originally arranged in chronological order, following the exploration history of the Kufra region from the 1928 visit of Doctor Brezzi, through the expedition routes of Kemal el Din (1925) to the 1933 visit of the Almásy expedition. When compared to the original publication the major difference between the copies is that they are all Italian translations. This is just partly because of easier communication, much more because of the ownership of the territory.

10.1 Preparation of Material and Map Compilation

An example of this attitude is the 1:1 million scale sketch map depicting the exploration of the areas west of Gilf Kebir. It is a copy of the 1932 Almásy-Clayton expedition map, published in the Geographical Journal, but with Italian title, notes are translated names. The expedition map originally showed the routes of the expedition and the main topographical features and landmarks along the routes. A further addition by the Italian maker is the inclusion of the international border line, which was not present in the model. The emphasis on the territorial division reveals that the border was crossed by the Almásy expedition (Török 2011), and, in a broader military strategic sense, it calls for the accessibility of Kufra from Egypt. This

map has nothing to do with espionage or secret information. The map editor supplemented the sketch with the main location of Kufra and extended the coverage as far south as the Uweinat Mountains. The reason for the inclusion of these two strategically important points was the defence of the international border.

Another map in the group already reflects the clear intention to include the geographical information represented on the expedition route maps in the construction of topographical maps. The large sheet "Kufra, Auenat, Gilf el Nebir" (sic!) at 1:1,000,000 scale, at first sight, is an original work covering a large region of the southern international border. A closer look reveals that is a compilation work that combines the 1931 Bagnold map, introduced above, with the 1932 Almásy-Clayton one. By simply rearranging the two parts of Bagnold's original and adding new information about the Gilf Kebir region the compiler successfully created a cartographic overview of a contested region along the international border.

11 Topographic Maps with White Spaces

These Italian military sketches were most probably part of the preparations for the construction of Italian military topographic maps, and it is not a surprise if their content appears unchanged. As we have limited information regarding the technical processes of the making of the topographical map series, the relevant sheets of the *Carta dimostrativa della Libia* were examined as material evidence of the technical, but also some mental procedures (Török 2008). The Italian military and colonial cartographers, like any professional map maker in the 1930s, held all the preconceptions of modern cartography, either they worked in the field in the colony or they worked in the Istituto Geografico Militare in Florence, Italy. How would they solve the inherent problems of the European rational and empiric system to make a geographic archive in graphic form, a 'true map', when encountering the mapping of the Lybian Desert?

The sheet *A'rchenu* in the 1:400,000 scale *Carta Dimostrativa della Libia* proves this general statement. This official map was constructed from expedition material after 1934: the topographic mission of Captain Marchesi and the publication of the Almásy-Penderel report in the Geographical Journal are mentioned in the marginal note. The label "Almasy-Penderel 1933" appears twice along the route of this expedition. It is noteworthy that Almásy's track from the Gilf Kebir to Kufra is partly shown with a directional arrow, presumably for security reasons the last section, near the oasis (actually on the next sheet) was omitted. Italian interest in Libyan colonial territory reached the area of the Uweinat mountains at the 22° northern latitude, which is the mark of Egypt's southern international border.

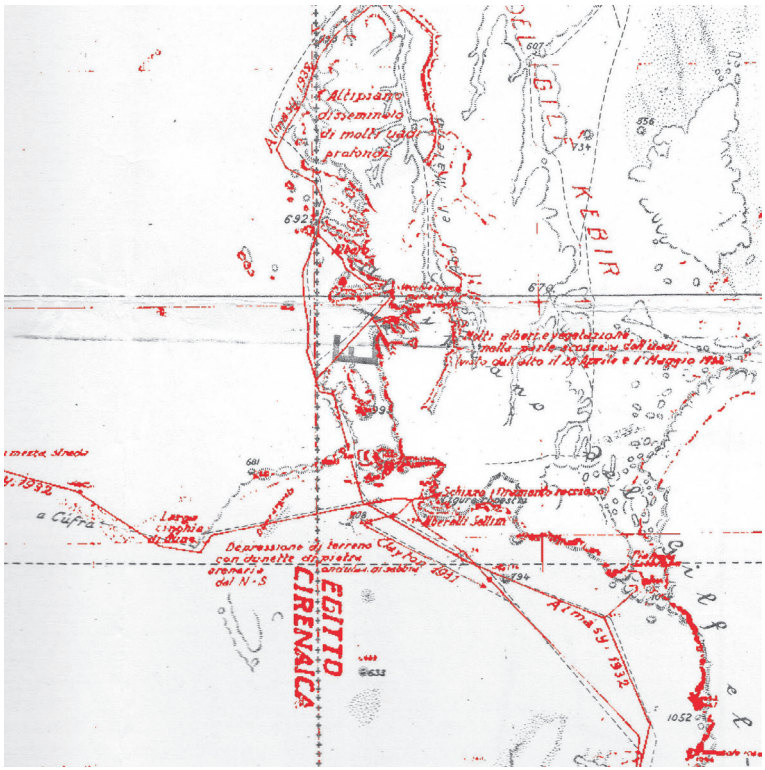

Figure 4 Comparison of an Italian sketch of the route map of the 1932 Almásy-Clayton expedition (in red) and the content of the 1: 1,000,000 topographic map sheet 'Cufra' (1938)

The sheet *Cufra* in the *1:1.000.000* series of the *Carta Dimostrativa della Libia*, which was published in 1938, covers the Gilf Kebir and Uweinat region. Although the colonial institutions were very much aware of the importance of reliable topographic maps and were anxious to collect more information, it is somehow amazing how empty this sheet remained. Compared to the larger-scale map, published a few years earlier, it is apparent that nothing changed. The area west of the Gilf Kebir is still without any graphic content as beyond the coordinate grid and the expedition routes indicated (but this time the explorers' names were not included) the map is empty, and there is no geographic object represented.

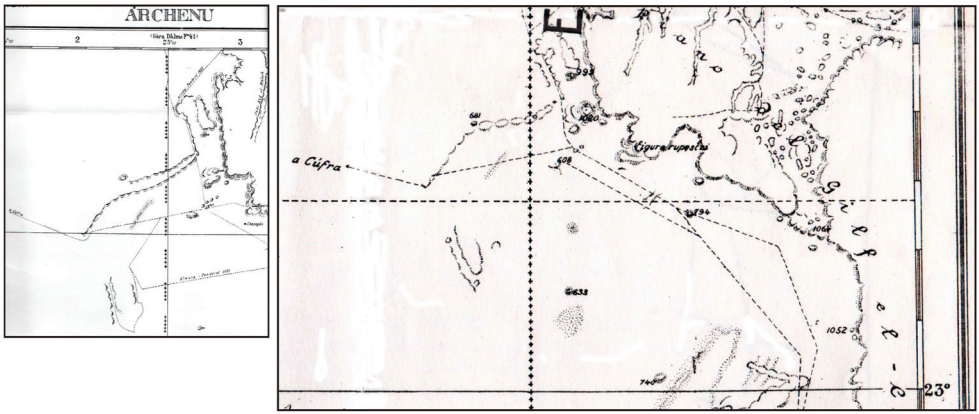

Figure 5 Comparison of the region east of Kufra oasis on two Italian topographic maps: detail of the 1:400,000 sheet 'Árchenu' (1933; left) and the same area on the 1: 1,000,000 sheet 'Cufra' (1938; right)

12 "Cartography as Science and Art"

The emptiness of the maps is not the conclusion of the missing topographic survey in the region – how one may think. Although the use of expedition maps, the information collected by route survey would inevitably result in large empty spaces between the narrow strips of 'known' territories along the routes. Route surveys are not suitable for modern topographic mapping. Topographic maps are based on a systematic, territorial survey. But this is not the case here, because it was practically impossible to conduct extensive survey work covering the inner desert. Instead, the Italian mapmakers used various sources they had, worked with heterogeneous information and did their best to compile the sheets up to contemporary standards. Had the Italian military cartographers surveyed the region, the emptiness of the desert maps would have remained the same. The reason for this limitation was the mapping ontology they adopted, which made them unable to represent anything beyond a limited set of categories.

The legend on the sheet lists the conventional signs (*Segni convenzionali*) systematically used by the cartographers. The primary importance was given to the linear sign of the international border, which is on top of the list. Topographic mapping is territorial, this is why the delimitation of the territory is the first object mentioned. Next other linear signs and different types of communication lines are represented, their characterization is based on suitability for automobiles. Further below we have a longer list of point-like objects, where the first signs are related to water. Indeed, without

water, there is no life in the desert, but once you have a permanent spring or well the desert becomes an oasis. The rest of the conventional signs are related to human habitat (e.g. fortress, mosque, cemetery) occasionally noting the local Arabic name of the object (e.g. *Moschea o Závia*).

What is missing from the list of signs is any representational convention related to the desert landscape. And here is the cartographers' trick: they represent the high mountains and the large and prominent hills with form lines, as well the characteristic dune chains and *wadis* that are visible for the navigator – and simply consider anything else insignificant. This is the thinking that Bagnold explained in his Note on his expedition map regarding crested dunes (mentioned above), but the lesson comes from the roots of Enlightenment cartography. Already the editors of the maps of the Napoleonic survey ignored desert regions, which were not mapped as a field – but represented caravan routes, immaterial objects.

The graphic depiction of the desert was symbolic on the maps with a reddish-yellowish background, the colour of the surface. In the case of characteristic chains of dunes, they used dotted form lines indicating bulging. When the draughtsman had spare time to demonstrate his artistic talent the desert areas were filled with tiny physiographic symbols, giving the reader an impression of the landscape as if it were seen from above. Working with areas covered by dunes they always used dots, not lines, to avoid any solid localization. Dots with different sizes reflected shadows of the slopes, the steeper sides were darker. This is another evidence that these topographic maps did not represent comprehensively and accurately what was in the territory. However, there is a huge difference between the blank spots of unknown territories and the empty spaces created by cartographic ontology.

The emptiness of the maps of the desert is misleading for the common map reader, as these 'blank' spots stand not for 'unknown', but substitute 'flat and featureless sand' and similar descriptions of a landscape. The desert territory could be considered irrelevant and uninteresting – but still was an important expanse. Although the map maker may draw nothing on the paper, make sure, the desert was there. Although marking nothing the mapmaker represented something, desert as a geographic entity. One could find hardly a more instructive example of why geographic and cartographic ontologies are different and related. The Bellman's chart, an empty map sheet, which is presented as another cartographic absurdity by Carroll (1876) is not an absurdity. Empty charts of water bodies and desert map sheets do exist because of the ontological preconceptions of the cartographic ideal – and they do nearly as well as the territories.

13 Conclusions and Outlook

Using the exploration and mapping history of the western part of the Libyan Desert we tried to reveal some of the cartographic processes which resulted in Italian topographic maps in the 1930s. Although not very much is known about the relations of the maps and map makers, the hard evidence of the maps could reveal some direct connections between the earlier and the later works. The modern European exploration of the region started with the Napoleonic survey of Egypt, a typical Enlightenment enterprise. It was the 1873-74 Rohlfs expedition, whose route map already shows the characteristics of all later works. The depiction of the desert on route maps was not the portrayal of the actual landscape, only some landmarks were indicated graphically. Route maps illustrated a story and included information related to the journey. On Bagnold's expedition map, a dead camel or the hawks were observed in the field and became geographic objects. In the 1930s Italian cartographers used route maps to compile sheets in the topographic map series of the colony.

Of course, Italian map makers could do excellent surveys and construct wonderful maps. In the spring of 1933 Captain Marchesi's topographic mapping unit surveyed the Uweinat Mountains (Marchesi 1933). In the following year in the treaty of Rome, the Sarra triangle was ceded to Italy. The southern border of Libya was demarcated by Colonel Agostini. The new international boundary was prominently featured on the Italian topographical map sheet *Cufra* (1938), published on the eve of World War II. This process transformed the formerly fluid Libyan-Egyptian border into a defined abstract entity, then a cartographic object and in the end a geographical entity in the field in the form of border markers. Some have survived the colonial period as the modern international border is the same, so the 1934 border markers are still there in the desert. But before we would think that a 'fiat' border has gained physical existence, we should consider the always limited accuracy of any border demarcation measurement, which means that international border markers are never the real borders.

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