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Geographical Health Education for knowing and preventing risk factors

Cristiano Pesaresia

^a Dipartimento di Lettere e Culture Moderne, Sapienza University of Rome, Rome, Italy Email: cristiano.pesaresi@uniroma1.it

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Abstract

In this contribution the importance of a geographical health education perspective is underlined, and the need to promote a widespread and shared awareness of this topic has led to the introduction of a new type of feature focused to the related aspects with this number of J-READING. In particular, in the present work, first of all the potential added value of harmonious and coordinated health education actions is underlined, aimed at translating the findings of scientific research for social usefulness, also focussing the attention on the need to avoid incorrect behaviour which can put people at risk of specific diseases and disorders. Secondly, a reflection is provided about the leading causes of death and risk factors, highlighting the differences among geographical areas and countries on the basis of a number of indicators which continue to show considerable inequalities and reveal facets and problematic conditions of many contexts with development delay, above all in Sub-Saharan Africa. The imbalances in basic maternal and children health services continue to be burdensome and the system too feeble to face communicable diseases, often easily preventable and treatable, even if some encouraging achievements have been recorded in the last years. Thirdly, the attention is dedicated to the health risk factors and noncommunicable diseases in the developed countries and a focus is provided on the European countries. The use of tobacco, the abuse of alcohol, an unbalanced diet and physical inactivity (which together contribute to overweight and obesity) here are remarkable risk factors for chronic diseases, but their incidence could be easily reduced by encouraging and supporting at school and at educational level adequate programmes, "best buys" and supplementary interventions for assuming better behaviour. Some perspectives for geographical health education are finally discussed considering the potentialities of geotechnologies, WebGIS and open source GIS, specific app and services, story maps and digital storytelling.

Keywords: Causes of Death, Communicable Diseases, GIS and WebGIS, Health Education, Noncommunicable Diseases, Risk Factors

1. Remembering the past... thinking to the future

Seven years have passed since that April 2012, when Gino De Vecchis (National Presi-

dent of the Italian Association of Geography Teachers – AIIG in the 2002-2018 period) invited me and the colleagues Riccardo Morri (now National President of AIIG) and Marco Maggioli (at present member of the Scientific Committee of the Journal) to discuss: J-READING's (Journal of Research and Didactics in Geography) main aims; its template and the author's guidelines; the peer review process; the web site map; the sponsoring organizations and other related issues. It was the first briefing aimed at discussing some basic elements useful to have a flexible structure to debate and expand with the contribution of the Italian Association of Geography Teachers National council, starting with a well thought out frame. I clearly remember that a shared enthusiasm united us and made us part of a common project, ardently desired by Gino De Vecchis, the Founder and past Editor in Chief of J-READING, and welcomed by us all.

So, in the contribution *J-Reading is born*, many focal points were underlined, starting from the following consideration (De Vecchis, 2012, p. 7).

The aim of contributing to the construction of a bridge between didactics and research, strategic for the development of the subject, is at the basis of this new editorial project, which, inserted in the history of the AIIG, sets out to highlight its international approach that is so essential in a globalised world. The terms didactics and research, in fact, complement each other and combine for a solid cultural education in order to deal with analyticalinterpretative and educational-professional needs.

And then specific aspects and themes, research lines, educational perspectives were advanced and proposed, since there is the need for this at international level (De Vecchis, 2012, p. 8)

to show the diversity of paths and approaches of contemporary geography, including the elaborations of new models and theories, mathematical data processing, the application of new mapping and statistical calculation techniques in computerised cartography and in the geographical information systems (GIS), which have considerable application possibilities in the sociodemographic and economictourist fields, in terms of environmental and cultural heritage and risk analysis etc.

giving also considerable importance to the geographies of perception and behaviour and the thorny relationships among different forms of development and technological progress, resources and landscape preservation, social inclusion and territorial identity.

To face these issues and reach important aims, the importance was also highlighted: to create a synergy between scientific theory and didactic practice; to promote educational and scientific-disciplinary transversalities; and to support exchanges between researchers and teachers, in order to set up a virtuous circle able to provide tangible added value in the field of research and modalities and strategies in didactics.

Successively, in the contribution Some keywords of J-Reading, three keywords were discussed as they were considered particularly worthy of note (De Vecchis, 2013, pp. 5-6): international comparison that "makes it possible to evaluate, from a comparative point of view, the state of the art relative to the teaching of geography at the various levels of school and university"; interdisciplinarity that is necessary to pursue ambitious results which "require joint planning among the various sectors of scientific research"; and geospatial technologies since "the use of dedicated instruments, digital cartography software, the analytical interpretation of satellite images represent a crux of a geography in progress, the scope of which is to unite theoreticalmethodological skills with practical-operational ones".

Therefore, in order to promote a periodical sectorialisation and a profitable discussion and deal with specific aspects, some features were introduced in addition to the customary scientific papers.

In this perspective, with the present number of J-READING another type of column has been introduced and it is dedicated to "Health Education" since a considerable need for rigorous input and clarity is advised and perceived on these topics and because there is a close relationship between the health of the environment and population.

Furthermore, a widespread educational attainment, obtained with school and university learning but also through specific pathways and multifaceted actions for the completion of formal training, is considered a crucial determinant of health and lengthening of life (Yamashita et al., 2019, p. 329). So, health education (HE) is given by the proactive combination of learning experiences and situations aimed at promoting voluntary actions conducive to psycho-physical well-being and health literacy plays an essential role in terms of the promotion of health at school and social-pedagogical implications useful for life (Fane et al., 2019, pp. 289, 291).

Furthermore, the role of health education increases at the light of global migration flows, since they can have a tangible "impact on those who move and those who stay behind, through a whole range of new stresses, pressures and demands" (Thomas et al., 2019, p. 3), reappearance of (partially) eradicated infections and combinations of diseases. The amount of these flows brings about important effects "including the challenges presented to global health systems as the consequence of escalating health care demand" (Spencer et al., 2019, p. 97) and it requires an inclusive aptitude and correct behaviour right from the school years, in order to facilitate a virtuous health system and give everyone the possibility to guarantee their health status.

The profitable repercussions on the educational process regarding themes and aspects of great social usefulness can be countless and manifold. The possibilities of geographical and interdisciplinary analysis are rich in many facets, from conducting detailed territorial screening to recognizing anomalies, analogies and differences. Remarkable perspectives can be opened up in order to add additional tiles to the present state of the art, towards a scientific progress which can provide tangible benefits for people and especially young people. There are various approaches which can lead to the identification of risk factors (endogenous and exogenous), polluting sources, abnormal incidences and the prevalence of diseases, areas with insufficient levels of sanitary services or subject to people fleeing owing to their inefficacy and inefficiency. There are many possibilities whereby to evaluate the imbalance factors, territorial inequalities, gap levels at international level or in a kind of "Chinese box", varying the administrative levels for successive comparisons.

In all these cases, the use and elaboration of quantitative and qualitative data, the sample re-

search and the direct involvement of residents in cohorts and case-control studies, GIS applications along with the WebGIS and ArcGIS Online functionalities can support important findings which must be widespread and shared in different ways, so as to reach a greater number of people and to support an adequate awareness and education process to health, in addition to promoting innovative and rigorous research lines and projects.

Similar reflections acquire particular emphasis considering that, for example in Europe and in North America, a widespread increase of diseases seems to have been recorded (such as some neoplasms) with high mortality often related to the alteration of the environment due to: impressive cementation; poisonous emissions; impactful activities: indiscriminate disposal of hazardous waste and toxic substances: massive use of pesticides and antiparasitic substances in agriculture or glues and noxious materials in constructions, furniture and cosmetics; pollution of soils and water sources; spasmodic research of all at once. Moreover, cardiovascular and cerebrovascular diseases continue to represent the first causes of death in the developed countries sometimes for incorrect behaviour (i.e. smoking, use of alcohol and drugs, overweight and obesity, sedentary life, irregular rest etc.) which could be rectified through shared educational projects on a large radius, with tangible improvements. Moreover, with the lengthening of life expectancy, an increase in the cases of the loss of cognitive abilities is recorded and determines the adaptation of the social and healthcare systems to the needs of people of fourth and fifth age, with a rise in expenditure and the need for specific planning.

On the other hand, there are countries, for example in Sub-Saharan Africa and the Middle East, where the leading killers of children continue to be diseases that are easily preventable and treatable: causes of death due to risk and transmission factors which are intolerable and the symptoms of huge disparities. In fact: "Every year, millions of children under 5 years of age die, mostly from preventable causes such as pneumonia, diarrhoea and malaria. In almost half of the cases, malnutrition plays a role, while unsafe water, sanitation and hygiene are also significant contributing factors" (UN IGME, 2017, p. 2). Similar infectious diseases represent urgent priorities since they are widespread plagues and ruinous scourges which show the other side of the coin: the side of underdevelopment. For example, wasting, stunting, underweight, the low amount of daily calories or diets that are very poor in protein and necessary micronutrients for an adequate growth and psychophysical development are the all too obvious signs of highly problematic conditions and severe states of debilitation which can put children at risk of the onset of diseases.

Thus, the social and health conditions of a country, the problems that weigh on the population but also the progress recorded over time can be analyzed in a perspective of interdisciplinary research by means of various combined indicators and elaborations, which make it possible to assess the international disparities in terms of development, risk factors and quality of life. It is possible to draw synthetic and detailed multitemporal and geospatial frameworks, bringing out and quantifying the main critical aspects of each context. In terms of strategic planning, this permits to recognize the weak points of specific areas and elements of common exhaustion of macro-areas, which should be faced with streamlined and focused programs; and this also helps to identify strong points and successful actions which could be replicated with particular and adaptable expedients in order to spread winning solutions for public usefulness (Palagiano and Pesaresi, 2011, p. 231). In fact, the documenting and monitoring of the successes of specific countries offer practical guidance for targeted interventions able to reduce the mortality of vulnerable age classes (newborns, children, pregnant mothers, people affected by particular diseases) and to face the major risk factors, inspiring potential solutions that can be translated into concrete planning (Alkema et al., 2016, p. 471).

Moreover, accurate studies are required to establish some essential key aspects which must represent the basis of appropriate behaviour and widespread education. There are numerous contributions shared by the web or with the publication of volumes without scientific foundations which can be misleading, contributing to feeding incorrect information and knowledge. It is for example the case of works on unbalanced diets, or on arbitrary and unapproved methods of facing serious diseases. It can also be the case of commercials and documents that exacerbate the use of new technologies (i.e. for the mobile network) leading to a deleterious abuse, both for the repercussions in terms of mood-apathyirritability, and for the departure from the aspects of real life and the direct effects on health due to particular kinds of emissions, now being monitored and evaluated in health research.

2. Leading causes of death and risk factors... monitoring health, with particular attention to countries with delay in development

A comparative and diachronic analysis "of the burden of diseases and injuries, and the risk factors that cause them, is an important input to health decision-making and planning processes" (World Health Organization, 2018a, p. 1). At the same time: "Tracking age-sex-specific death rates by cause is an essential component of health surveillance" and systematically observing "levels and trends in premature mortality is crucial to understanding how societies can address prominent sources of early death" (GBD 2016 Causes of Death Collaborators, 2017, pp. 1151-1152).

According to recent estimates (World Health Organization, 2018b)¹:

More than half of all deaths in low-income countries in 2016 were caused by the so-called 'Group I' conditions, which include communicable diseases, maternal causes, conditions arising during pregnancy and childbirth, and nutritional deficiencies. By contrast, less than 7% of deaths in high-income countries were due to such causes. Lower respiratory infections were among the leading causes of death across all income groups.

Noncommunicable [Group II] diseases (NCDs) caused 71% of deaths globally, ranging from 37% in low-income countries to 88% in high-income countries. [...]. $[...]^2$.

¹ Synthetic data and information are also reported at https://www.who.int/news-room/fact-sheets/detail/ the-top-10-causes-of-death.

² Noncommunicable diseases correspond to chronic diseases, which generally have long duration and contemporaneous slow progress and degeneration.

Injuries [Group III] claimed 4.9 million lives in 2016. More than a quarter (29%) of these deaths were due to road traffic injuries. Low-income countries had the highest mortality rate due to road traffic injuries with 29.4 deaths per 100,000 population – the global rate was 18.8. Road traffic injuries were also among the lead-ing 10 causes of death in low, lower-middle-and upper-middle-income countries.

The various risk factors, social and economic status, demographic structure, healthcare system and the capability to respond to the general request and needs, the cultural level of the population determine a series of combinations which have direct repercussions on the incidence and prevalence of different diseases and injuries and consequently on the main causes of death and life expectancy.

For example, life expectancy – which can be considered one of the first basic symptoms of the development achieved by a country – shows remarkable geographic differences and a gap of some years between females and males. At the top of the ranking there are above all the countries of Western Europe and East Asia, while at the bottom the African countries are to be found. As far as concerns females (Figure 1), according to the De Agostini - DeA WING 2019 data collection, some countries exceed the threshold of 85, with the maximum recorded in: Monaco (88.2), Japan (87.1), San Marino (86.8), Spain (85.7), France and Switzerland (85.3), South Korea (85.2), Singapore (85.1). The lowest values are instead recorded in Sierra Leone (52.4), Central African Republic (54), Chad (54.1), Nigeria (54.2), with a life expectancy of less than 55 years. There is, therefore, a difference of almost 36 years between Monaco and Sierra Leone. With regard to males (Figure 1), the values are generally lower with respect to females, but some countries are near or exceed the threshold

of 81 years, with the maximum recorded in: San Marino (82.7), Monaco (82.1), Switzerland (81.5), Japan (81), Liechtenstein and Norway (80.9). On the other hand, the lowest values concern countries that are below the threshold of 52 years: Central African Republic (50.3), Sierra Leone (51.3), Chad and Lesotho (51.7). Thus, the difference between San Marino and Central African Republic is about 32.

In a diachronic perspective, important achievements have been recorded during the last twenty years, both in developed countries and (relatively) above all in countries with a development delay where, nevertheless, many other steps must be taken. In fact, on the basis of the De Agostini – DeA WING 2000 data collection, for the females, the highest values amounted to 85 in San Marino and 84 in Japan, and the lowest values barely amounted to 37 in Malawi and 40 in Niger. For the males, the highest values, again observed in San Marino and Japan, amounted to 77, and the lowest, recorded in Malawi, barely amounted to 36, followed by Niger and Tanzania with 41.

Then, other essential inputs are provided by the under-five mortality rate, which depends on a series of aspects that can show the critical conditions related to "the limited access of children and communities to basic health interventions such as vaccination, medical treatment of infectious diseases, adequate nutrition and clean water and sanitation", in addition to cultural aspects which surround young mothers and carers accompanying children during this crucial and frail period of life (UN IGME, 2018, p. 4). The complexity and variety of the aspects that can contribute to maintaining the under-five mortality rate high are so many that some contributions have highlighted the need to assess different kinds of variables (defined "traditional and additional") in organic frameworks functional to operative actions and interventions, because these variables reflect the geographic and economic barriers to healthcare and involve indicators socially and culturally relevant to the planning setting (Rutherford et al., 2010, p. 517). "Mortality is the most direct and important indicator of health at the population level" and the under-five mortality rate becomes the mirror able to provide multiple reflection elements, especially if considered in the double perspective of spatial

The main categories of noncommunicable diseases are: cardiovascular diseases (heart disease and stroke); cancer; chronic respiratory diseases; diabetes. Since these diseases are strongly related to unhealthy lifestyles and daily risky behaviours, which lead to problematic conditions and metabolic changes, an appropriate lifestyle during childhood and youth, promoted by health education programmes, can help to prevent the onset of noncommunicable diseases in adulthood (World Health Organization, 2013, p. 7).

distribution and diachronic dimension (Li et al., 2019, pp. 1-2). Quantitative data, globally considered, shows very tangible improvements that in turn mean good results in the prevention, treatment, management of situations that tentwenty years ago would have led to death. Synthetically (UN IGME, 2018, p. 6):

Around the world remarkable progress in child survival has been made and millions of children have better survival chances than in 1990. The under-five mortality rate fell to 39 deaths per 1,000 live births in 2017 from 93 in 1990 [...]. This is equivalent to 1 in 11 children dying before reaching age 5 in 1990, compared to 1 in 26 in 2017. In most of the SDG [Sustainable Development Goal] regions the under-five mortality rate was reduced by at least half since 1990. In 74 countries, the under-five mortality rate was reduced by more than two-thirds. [...]. The total number of under-five deaths dropped to 5.4 [...] million in 2017 from 12.6 [...] million in 1990. On average, 15,000 children died every day in 2017, compared to 34,000 in 1990.

Despite this considerable progress, the underfive mortality rate continues to record very high values in many countries (Figure 2), where – according to the De Agostini - DeA WING 2019 data collection - sometimes it is more than 100‰: Somalia (132.5‰), Chad (127.3‰), Central African Republic (123.6‰), Sierra Leone (113.5‰), Mali (110.6‰), Nigeria (104.3‰). Overall, Sub-Saharan Africa is constituted by a compact block of countries which report serious levels of criticality. To think that in some contexts 100 or more children die before reaching their fifth year of age is a symptom of heartrending graveness, which must be framed in a global picture where several other countries have values of more than 80 and 90%. These data appear very mismatched considering that the levels are below the threshold of 3‰ in several European and East Asian countries, as proof of the possible achievable goal and they are very near 2‰ in Liechtenstein and Iceland (2.1‰), Slovenia and Finland (2.3%), Luxembourg (2.4%).

In the perspective of the potential results obtainable in the medium-short period through a programmatic and shared task at national level with the support of international organizations, to starkly flay stagnation conditions, a virtuous example is provided by Ethiopia, that has showed a notable trend in the last years: on the basis of the 2003 De Agostini – DeA WING data collection, a value of 174‰; according to the 2008 data collection, a rate of 164‰; on the basis of the 2013 data collection, a value of 105.9‰; according to the 2019 data collection, a rate of 58.4‰.

The keys to the success recorded in Ethiopia have been synthetically summarized below and represent the basic elements for promoting similar actions to expand and deepen their own responsibility and commitment to save newborn babies' and children's lives (VV.AA., 2015, p. 3).

• Sustained high level commitment and multisectoral policy platform — *contributions from inside and outside the health system, including economic development, agriculture, and education*;

• Broader access to basic infrastructure — *improved roads, electricity, telecommunications;*

• Rapid increase in growth in health funding, especially from international donors — *helped* expansion of health infrastructure and health work force;

• Comprehensive health sector planning and Health Extension Programme — *brought essential health services to rural areas*;

• Early adoption of global initiatives including MDGs [Millennium Development Goals] — *mobilised funding and drove stronger collaboration and partnership.*

Therefore, a series of integrated policies and multi-sectoral guidelines at community level has made it possible to feed a system able to accelerate the potential results achievable, directly neutralizing the main weak points and the determinant factors of the high under-five mortality rate, as for example: immunization; treatment of childhood illnesses; diet imbalances and food safety; access to health services and sources of drinking water; education and involvement of young women to reduce the burden of preventable childhood diseases also related to undernutrition-malnutrition; the funds allocated for improving the health care system and the primary services (Tadesse et al., 2015, p. 15).

Cristiano Pesaresi



Figure 1. Life expectancy for females and males in the 12 countries with the highest and lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.



Figure 2. Under-five mortality rate (‰) in the 12 countries with the highest and in the 13 countries with the lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.

There are many variables which can be considered in order to underline the remarkable imbalances and problems that characterise countries and macro-areas and to better understand the causes of high childhood mortality and the incidence and prevalence of specific diseases. These elements of frailty are often interconnected, triggering worrying vicious circles and exposing the bases of the already weak socialhealthcare system.

Among the combined indicators used at international level, in 2010 the Multidimensional Poverty Index (MPI) was introduced to contribute to understanding and evaluating "how many people experience overlapping deprivations and how many deprivations they face on average", providing useful input and reflection elements for national and international policies. In fact (UNDP, 2010, p. 95):

The MPI is the product of the multidimensional poverty headcount (the share of people who are multidimensionally poor) and the average number of deprivations each multidimensionally poor household experiences (the intensity of their poverty). It has three dimensions mirroring the HDI Development Index]—health, [Human education and living standards-which are reflected in 10 indicators, each with equal weight within its dimension.

Despite some limitations due to the sometimes limited availability of the combined data, the Multidimensional Poverty Index helps to refine the measures of the most serious forms of poverty and deprivation, since it "is an index of acute multidimensional poverty. It reflects deprivations in very rudimentary services and core human functionings for people" and it "reveals a different pattern of poverty than income poverty, as it illuminates a different set of deprivations". From a statistical and practical point of view (Alkire and Santos, 2011, p. 7):

The MPI reveals the combination of deprivations that batter a household at the same time. A household is identified as multidimensionally poor if, and only if, it is deprived in some combination of indicators whose weighted sum is 30 percent or more of the dimensions. The dimensions, indicators, and deprivation criteria are presented below and explained with detail in the following section.

- Health (each indicator weighted equally at 1/6)
 - Child Mortality: If any child has died in the family

• Nutrition: If any adult or child in the family is malnourished

2. Education (each indicator weighted equally at 1/6)

• Years of Schooling If no household member has completed 5 years of schooling

• Child School Attendance If any schoolaged child is out of school in years 1 to 8

3. Standard of Living (each of the six indicators weighted equally at 1/18)

• Electricity If household does not have electricity

Drinking water If does not meet MDG definitions, or is more than 30 mins walk
Sanitation If does not meet MDG definitions, or the toilet is shared

• Flooring If the floor is dirt, sand, or dung

• Cooking Fuel If they cook with wood, charcoal, or dung

• Assets If do *not* own *more than one* of: radio, tv, telephone, bike, motorbike or refrigerator and do not own a car or truck.

The MPI is the product of two numbers: the Headcount H or percentage of people who are poor, and the Average Intensity of deprivation A – which reflects the proportion of dimensions in which households are deprived.

According to the 2019 data collection (Figure 3), the Multidimensional Poverty Index shows the seriousness of African countries, where Niger (0.584), South Sudan (0.551), Chad (0.545), Ethiopia (0.537), Burkina Faso (0.508) and Somalia (0.5) sadly emerge for their values that are more than or equal to the threshold of 0.5. Particularly, Sub-Saharan Africa confirms its status of widespread delay and strongly summons attention. Nevertheless, the situation of some countries of South Asia is also worthy of note for the amount of population exposed to poverty. It is for example the case of India (with an MPI equal to 0.282) in 27th place of the ranking, and Afghanistan too (with an MPI equal to 0.293) in 23rd place.

Other data that can contribute to fuelling a discussion on the remarkable imbalances at international level and which reveal different facets of problematic conditions concern nutrition and consequently food safety, undernutrition, and malnutrition, both owing to the deficiency of specific nutrients and their overload, which determines overweight and obesity. There are, in fact, two categorical and counterpoised sides of the same coin: the side constituted by the countries where hunger is still an urgent and injurious problem which – with many features – involves a considerable part of the population and children, predisposing them to the onset of diseases, due to the debilitating state of the organism and its inability to respond to and counteract the infections; the side made up of the countries where overweight and obesity - together with other risk factors related to incorrect behaviour – are an assertive menace for the onset of chronic and degenerative diseases that are rife in these contexts and for different nutritional imbalances. There are also the mixed situations due to the coexistence of imbalances in deficit and in excess due to the fact that the possible combinations are multiple.

As recently summarized in the *Foreword* of the volume 2018. The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition (da Silva et al., 2018, pp. V-VI):

In 2017, the number of undernourished people is estimated to have reached 821 million around one person out of every nine in the world. Undernourishment and severe food insecurity appear to be increasing in almost all subregions of Africa, as well as in South America, whereas the undernourishment situation is stable in most regions of Asia. [...]. [...], we are concerned that in 2017, nearly 151 million children under five have stunted growth, while the lives of over 50 million children in the world continue to be threatened by wasting. Such children are at a higher risk of mortality and poor health, growth and development. [...]. In addition to contributing to undernutrition, the food insecurity we are witnessing today also contributes to overweight and obesity, which partly explains the coexistence of these forms of malnutrition in many countries. [...]. [...]. The problem of obesity is most significant [for example] in North America, but it is worrying that even Africa and Asia, which still show the lowest rates of obesity, are also experiencing an upward trend. Furthermore, overweight and obesity are increasing the risk of noncommunicable diseases such as type 2 diabetes, high blood pressure, heart attacks and some forms of cancer.

Some inputs to frame the remarkable differences and variegated combinations can for example come from the kcal/inhabitants per day, which express the ratio between the estimated average of the number of calories (kcal) which are available daily in each country and the total population of the same country (Figure 4). Considering the countries at the top and bottom of the ranking, according to the 2019 data collection, a considerable gap appears, since the maximum recorded in Austria is equal to 3812 kcal/inhabitants per day, while the minimum, recorded in the Democratic Republic of the Congo, is equal to 1590 kcal/inhabitants per day. Therefore, while several African countries denote a number of kcal/inhabitants per day less than the threshold of 2000, various countries record about the double of the values and these contexts are rather geographically spread (in addition to Austria): Belgium (3776), United States of America (3724), Turkey (3715), Montenegro (3701), Israel (3665), San Marino (3608), Ireland (3604), Italy (3583), Luxembourg (3547), Liechtenstein (3531), Egypt (3526). Obviously, the excessive number of calories can derive from a disproportionate assumption of fats, carbohydrates or animal proteins, or by a general heavy

food intake. An important "duty" is related to the incorrect behaviour learnt during childhood, as for example the repeated daily assumption of chips, pizza, candies, pre-packaged snacks, sausages, sodas and the concurrent lack of the habit eating vegetables and soup, fibres, juices and centrifuges and low-fat meat. Another negative contribution can derive from an abuse of alcohol that sometimes becomes unrestrained or above all in the case of young people concentrated on specific days, for example at the week end, with serious repercussions from different points of view. Furthermore, all these aspects are combined with a sedentary lifestyle that in young people can be also worsened by an excessive use of technologies and networks, video-games, mobile phones and other mobile tools, which steal time from physical activities and outdoor games.

Similar aspects and data act as a *trait d'union* to open up the way to more detailed considerations concerning some risk factors and preventable incorrect attitudes which strongly contribute to maintaining the incidence and prevalence of chronic diseases in developed countries high.



Figure 3. Multidimensional Poverty Index in the 25 countries with the highest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.



Figure 4. kcal/inhabitants per day in the 12 countries with the highest and in the 12 countries with the lowest values according to the 2019 data collection. Source: Author's elaboration on data De Agostini – DeA WING 2019.

3. Health risk factors, with particular attention to developed countries

With the improvement of the quality of life, public health interventions and vaccinations beyond the adequate coverage threshold and the related increase of life expectancy, populations are subject to other risk factors and the main causes of disability and death shift to the noncommunicable diseases. Many of the risk factors that influence the onset of these diseases are constituted by correctable risk factors, since it seems that a considerable number of premature deaths due to chronic diseases could be prevented and avoided through an adequate primary prevention and by reinforcing the healthcare systems with ad hoc solutions, enabling them to respond more promptly and effectively to health care needs (D'Andrea et al., 2015, p. 34).

Therefore, cardiovascular diseases and cancer are today's scourges of developed countries and of the European countries for example, where their contribution gives rise to different combinations.

As far as concerns ischaemic heart diseases

by NUTS 2 regions, on the basis of the 2010^3 Eurostat standardized death rate per 100,000 inhabitants (Figure 5), the geographical distribution shows a considerable range of values (minimum value 29.2; maximum 590.8), with generally the highest impact in the Eastern and Northern contexts. A remarkable block of regions subject to the values of the highest class involves, in the East part of Europe, Bulgaria, Romania, Hungary, Slovakia, Czechia, and partially arrives into Austria, Germany and Poland; Finland, Sweden and Ireland also emerge in the Northern part. In the Western area, Portugal, Spain, France, Belgium and the Netherlands record widespread values falling in the lower class and Greece represents an exception with respect to the other Eastern countries. The regions of Italy, in this comparative optic, have above all values pertaining to the medium-low class.

With regard to cancer by NUTS 2 regions, according to the 2010 Eurostat standardized death rate per 100,000 inhabitants (Figure 6), the geographical distribution denotes a more restrained range of values (minimum value 184.8;

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³ At the moment of this study, these are the most recent comparable standardised data available from the Eurostat online database in a re-processable way.

maximum 375.4) and underlines heavier conditions in the regions of Hungary, Slovenia, Slovakia, Czech Republic and Poland, in the Eastern part of Europe, and in the Netherlands and Ireland, in the Western area. In a polychrome situation, where some regions denote high values are to be found the United Kingdom, the North of France, the West part of Romania, and the North-East Greece, and also Italy is characterized by a certain variability but without values of the highest class. The regions of Switzerland, Austria, South Germany, East part of Spain, Finland and Sweden show virtuous conditions.

So, some years ago, specific interventions were recognized as "best buys", that it is to say, actions able "to produce accelerated results in terms of lives saved, diseases prevented and heavy costs avoided" (World Health Organization, 2011, p. 4):

- Protecting people from tobacco smoke and banning smoking in public places;
- Warning about the dangers of tobacco use;
- Enforcing bans on tobacco advertising, promotion and sponsorship;
- Raising taxes on tobacco;
- Restricting access to retailed alcohol;
- Enforcing bans on alcohol advertising;
- Raising taxes on alcohol;
- Reduce salt intake and salt content of food;
- Replacing trans-fat in food with polyunsaturated fat;
- Promoting public awareness about diet and physical activity, including through mass media.

In addition to these, other actions were defined by highlighting the crucial role of school and education to create the prerequisites and the environment able to accept and adopt suitable measures. They are simple and easily achievable goals that however require a context ready to absorb them and to profitably put them into practice; they also require adequate solutions for diffusion, for example through geotechnologies, web, social networks and other mass devices that can leave a tangible impression on the collective imagination. Particularly, the integrative interventions would concern (World Health Organization, 2011, p. 4):

- Healthy nutrition environments in schools;
- Nutrition information and counselling in

health care;

- National physical activity guidelines;
- School-based physical activity programmes for children;
- Workplace programmes for physical activity and healthy diets;
- Community programmes for physical activity and healthy diets;
- Designing the built environment to promote physical activity.

Synthetically, the use of tobacco, an inadequate diet and scarce physical activity (which together contribute to overweight and obesity) and the heavy use of alcohol are recognized as the main risk factors both in the "best buys" and supplementary interventions, which should be encouraged at school and at educational level. Similar measures can simultaneously produce benefits for cardiovascular diseases and cancer, and with particular reference to neoplasms the following actions have also been recommended: vaccination against Hepatitis B - a main cause of liver cancer - and human papillomavirus (HPV) - the main cause of cervical cancer; adequate attention against exposure to specific risk factors at housing or occupational level, as for example asbestos, radon and contaminants in drinking-water; screening for breast, cervical and prostate cancer.

The scientific literature (D'Andrea et al., 2015, pp. 42-47), as far as concerns cardiovascular disease (CVD), added to the above (the use of tobacco, an inadequate diet and poor physical activity, the heavy use of alcohol), other modifiable risk factors: high blood pressure; diabetes; dyslipidaemia; social determinants (i.e. work-related stress and depression have been linked to the development of cardiovascular risk factors, such as hypertension and atherosclerosis).

At the same time, the scientific literature (Boccia et al., 2015, pp. 68-75), on cancer, added to the previous other risk factors on which it is possible to intervene with suitable practices, as for example related to: eradication actions and changes in hasty dietary practices (i.e. avoidance of raw fish above all in conditions with poor hygienic measures, or incorrect cooking methods which for example cause burns and release harmful substances); evaluation and measurement of the presence of specific pollutants; aspects concerning reproductive factors and exogenous hormones; an indiscriminate exposure to solar radiation, particularly during childhood; assumption of some types of drugs.

As previously underlined, tobacco smoke is a critical factor for the onset of cardiovascular diseases and some neoplasms, particularly those to the lungs, especially if people approach this habit when very young and living in contexts where smoking is a rooted tradition (and moreover the exposure to passive smoke is greater) and if the number of daily cigarettes is high (more than 20 per day), above all when these are characterized by a relevant tar content (Palagiano and Pesaresi, 2011, pp. 286-287). Many studies have evaluated the impressive impact of tobacco on overall health, considering crucial aspects as for example duration, type, quantity of cigarettes and mode of smoking, and ending up by affirming that smoking has the potential faculty to kill 50% more people than HIV/AIDS and to be responsible for 10% of all deaths globally (Mathers and Loncar, 2006, pp. 2013, 2021). Therefore, smoking should be considered the most significant preventable cause of death in the developed countries, causing some million premature deaths globally each year. And it is very important because: "Cigarette smoke is a major risk factor for cardiovascular disease (CVD) and the second leading cause for CVD mortality after high blood pressure" (Keto et al., 2016, p. 1); "Tobacco use is the leading cause of lung cancer; 55% of lung cancer deaths in women and over 70% of lung cancer deaths in men are due to smoking" (O'Keeffe et al., 2018, p. 1).

In this examination, one must also bear in mind that (Schane et al., 2010, pp. 5-6):

Complete cessation is one of the most costeffective interventions and provides a benefit nearly as large, if not greater, than other widely used forms of treatment for the secondary prevention of cardiovascular disease. Cessation is the only known primary therapy that can significantly reduce the risk of cancer and obstructive lung disease. [And also] Light and intermittent smokers often go undetected because many of them do not view themselves as smokers and will deny their habit when asked.

Moreover, in a systematic review of up-todate epidemiological research and evidence, it has been highlighted that "passive smoking is significantly associated with an increasing risk of many diseases and health problems, especially diseases in children and cancers" (Cao et al., 2015, p. 10). There are consequently various aspects and implications that must be considered because cigarette smoke is a huge menace for severe morbid forms and complications.

Another plague, albeit with different facets, is constituted by alcohol, which seriously contributes to serious psychiatric disorders and comorbidities (Yang et al., 2018) and causes negative implications on cardiovascular diseases and different forms of cancers, in addition to nutritional imbalances and liver cirrhosis, above all in the case of chronic abuse (Palagiano and Pesaresi, 2011, pp. 291-292). A particular risk factor, related to alcohol consumption, is represented by binge drinking "commonly defined as consuming five or more standard drinks per occasion [in about two hours] for men and four or more drinks for women, typically begins in adolescence" and it "is known as the '5+/4+' binge definition". In terms of acute health damage, binge drinking is connected to alcohol poisoning, impairment in cognitive functioning and motor coordination, involvement in car crashes, physical offense and sexual crime, and an increase of the risk concerning sexually transmitted infection (Chung et al., 2015, pp. 1-2). All these negative effects are obviously further accentuated in case of an even more risky behaviour, known as high-intensity drinking that increases the threshold to "8+/10+" or "12+/15+" drinks for women/men (Patrick and Azar, 2018, p. 6). Synthetically, the immediate possible consequences have been summarized in physical, legal, social, emotional and cognitive outcomes and disorders (Krieger et al., 2018, pp. 5-6), to the point of developing into potential different diseases in cases of prolonged use.



Figures 5 and 6. Above, death due to ischaemic heart diseases by NUTS 2 regions, on the basis of the 2010 Eurostat standardized death rate per 100,000 inhabitants, in the European countries. Below, death due to cancer by NUTS 2 regions, according to the 2010 Eurostat standardized death rate per 100,000 inhabitants, in the European countries. Source: Author's elaborations on data and system Eurostat (https://ec.europa.eu/eurostat/data/database) using the quantiles method.

Moreover, the unbalanced dietary intake with high and ongoing consumption of fat sugary foods and drinks from childhood, very often with the consumption of trash food – and physical inactivity (caused by the daily routine, the sedentary attitude of many works and the exaggerated use of digital devices also in children and young people) were conducive to the spreading of overweight people and obesity (Foley et al., 2019, p. 139) that for the developed countries is considered one of the worst noninfectious global epidemics in history (Bracale et al., 2013, p. 184). Worldwide obesity, which has nearly doubled since 1980, is one of the most dramatic risk factors for various chronic diseases, above all if it remains untreated. In fact, at global scale, 44% of diabetes, 23% of ischaemic heart disease and an amount of 7%-41% of some cancers are related to overweight and obesity and an alarming number of at least 2.8 million deaths each year is caused by being overweight or obese (Colao et al., 2017, p. 1; World Health Organization, 2015)⁴. These data highlight the need for a rigorous control of the early ages first of all by parents and schools, in a proactive synergy that can improve the quality of life and reduce the number of deaths related to overweight and obesity. An excessive weight during childhood and in mid-adolescence puts children at risk of different kinds of health problems and can also affect the possibility of having a balanced and muscular body during the following years, with other repercussions at psychological level. Moreover, it sometimes makes people adopt poor diets to lose weight quickly and it causes other deficiencies in important nutrients and a loosening of muscle fibers. Therefore, since adolescent obesity tends to predict adult obesity and related morbidity, this period is an essential life phase for correct guidelines and for the active presence of parents and educators, who must carefully follow young people, both in food choice and in removing accentuated sedentary behaviour, and establishing healthy lifestyle aptitudes (Patton et al., 2016). Generally, overweight and obesity, causing severe social, psychological and physical repercussions, seem to be associated with an amplified risk of morbidity and mortality due to considerable metabolic changes connected to dyslipidaemia, sleep apnoea, type II diabetes mellitus, osteoarthritis, pulmonary diseases and hypertension, in addition to ischaemic heart diseases and some types of cancer (Materko et al., 2017, p. 108).

An excessive body mass index (BMI, calculated as the weight, in kilograms, divided by the square of the height in meters)⁵ and waist circumference⁶ can be predictive and symptomatic elements of future problems and must not neglected and should become aspects to be kept under systematic control. In order to consider various delicate implications of the problem, it has been recently suggested to evaluate the BMI, waist circumference (WC), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR) and waist/height^{0.5} (WHT.5R) as the five anthropometric predictors of the whole-body fat percentage and visceral adipose tissue mass, able to improve and analyse the characterisation of obesity (Swainson et al., 2017).

Similar attention and precautions are increasingly needed because much incorrect behaviour is widespread among the population and, in the field of diet and nutrition, an alarming tendency seems to have developed in the spreading of misleading and sometimes harmful guidelines through media channels that convincingly suggests, albeit with no scientific consensus, foods to consume or avoid. As a result, in some cases, the adherence to these (not)guidelines is conducive to the onset of deficiencies, for example, in important nutrients, vitamins and minerals, thus causing negative effects and impairment in the short-medium term.

⁴ For further synthetic data and information see also https://easo.org/media-portal/statistics/.

⁵ Synthetically, a person can be considered overweight if the BMI is \geq 25 and <30, while is considered obese if the BMI is \geq 30. Then, in analytical studies different thresholds for women and men can be adopted, according to various countries and in order to have detailed subdivisions. For example, Calle et al. (1999, p. 1098) defined the following 12 BMI categories: lower than 18.5, 18.5 to 20.4, 20.5 to 21.9, 22.0 to 23.4, 23.5 to 24.9, 25.0 to 26.4, 26.5 to 27.9, 28.0 to 29.9, 30.0 to 31.9, 32.0 to 34.9, 35.0 to 39.9, and 40.0 or higher.

⁶ According to different studies, recommended cutoff points for waist circumference can be <94 cm for men and <80 cm for women (Flegal, 2007; Abbasi et al., 2013).

4. Some perspectives for Geographical Health Education

In terms of geographical health education, the disciplinary approach – also in collaboration with other research sectors such as social medicine, epidemiology, chemistry and biology, healthcare statistics etc. – can contribute to adding innovative elements to the state of the art, both by defining shared operating systems and methodology and by finding new geo-tools for a widespread awareness to the problems.

Important inputs and perspectives are associated with the use of geotechnologies and GIS which can open up important and diversified paths to socially useful planning and research, on the basis of the needs of the population and public decision makers according to the characteristics and problems of the different contexts.

As underlined in a previous contribution, GIS applications and geotechnologies make it possible to (Palagiano and Pesaresi, 2011, pp. 317-318):

- support comparisons among different contexts, at various geographical scale, to identify the main noncommunicable diseases and causes of death, underlining analogies and dissimilarities, recognizing macro-areas with similar patterns and trends, identifying the possible causes and reflecting in a relational optic;
- conduct meticulous territorial screening, loading together detailed quantitative and qualitative data, census sections shape files, satellite basemaps, in order to conduct analytical virtual surveys in areas most affected by specific diseases, in search of sources of pollution and risk factors, displayable and geolocalizable on digital maps;
- identify the preferential ways of the spreading of infectious diseases which are transmitted through unsafe water, contamination with waste or through carriers, after identifying the location of the polluted sources or areas of the thickening of insects carrying the infection, and also calculating the possible spread radius and directions of the diseases;
- recognize the source of risk and the means of transmission of a pathology on the basis of its

strong concentration in a specific zone;

- compare areas with different levels of naturalness to advance hypotheses and conduct relational analysis of air quality, expressed by predefined environmental indicators, and prevalent diseases;
- verify if there is a direct relation between the increased use of pesticides, or the massive development of industrial activities and a higher risk of contracting certain diseases, and this being the case, how far away from the context in question;
- evaluate the relationship between a high concentration of pollutants, or fine dust or other presumed harmful substances, and the prevalence of certain diseases, according to the data obtained with field surveys;
- understand if the population, observed by age group, lives appropriately close to basic health and hospital services, evaluating the need to open new facilities in areas that are poorly served;
- find the optimal localization for future care services or paediatric services in relation to the population density, the number of elderly people (since there are different needs also on the basis of the third, fourth and fifth age) or children, to the presence of similar facilities;
- make assessments, on a detailed scale, taking into account the number of public and private facilities, the relative number of beds, the medical and nursing staff who work there and, at the same time, the actual request, so as to reason over the general adequacy and recognize the areas that require an imminent strengthening of the system.

Furthermore, GIS applications and geotechnologies can provide a considerable added value for particular functionalities of spatial and temporal analysis, for example about how to draw upon hospital emergency departments to:

- process, represent and examine the access and eventual admission data, in order to identify on digital maps the areas from which the largest number of requests and inadequate requests for assistance arrive and to investigate them according to the presence of basic health services, the population's level of education, professional position and the percentage of foreign immigrants. In fact, different studies have underlined that overcrowding in emergency departments is a pressing problem to the point of speaking of a national crisis in different countries, requiring strategical planning and strategies to decrease this critical situation (Yarmohammadian et al., 2017; Barish et al., 2012; Caporaletti et al., 2018).

As far as concerns the applied and conceptual studies which have demonstrated the important role of geotechnologies in scientific health research, they can for example be highlighted as follows:

- "Using GIS analysis combined with molecular epidemiological surveillance can be an effective method for identifying tuberculosis transmission not identified during standard contact tracing methods" (Moonan et al., 2004, p. 9).
- "The spatial scan statistics methodology [...] has a potential use in surveillance of tuberculosis for detecting the true clusters of the disease" (Tiwari et al., 2006, p. 1).
- "The first step in cancer control is identifying where the cancer burden is elevated, which suggests locations where interventions are needed. Geographic information systems (GIS) and other spatial analytic methods provide such a solution and thus can play a major role in cancer control" (Pickle et al., 2006, p. 1).
- "A validated dispersion model was used as a proxy for dioxin exposure, yielding [different] exposure categories. The latter were linked to individual places of residence, using Geographic Information System technology", in order to evaluate the related risk of invasive breast cancer (Viel et al., 2008, p. 1).
- "GIS can dynamically map malaria hot spots it also point outs the geographic locations of hot pockets within to carry out accelerated focused malaria control by State Health Authorities. [...]. The main advantage of the GIS platform is fast data updating, as soon as data is entered revised maps are ready highlighting the trouble spots. [...]. Web hosting can give a new perception to malaria data management, global information dissemination and sharing" (Srivastava et al., 2009, p. 8).

At the same time, various examples of WebGIS and open source GIS have been struc-

tured and tested: for HIV/AIDS management in under-resourced contexts (Vanmeulebrouk et al., 2008): to enable a suitable visualization. exploration and diffusion of prevailing vulnerabilities to vector-borne viral infections (such as dengue feonline environment ver) in a dynamic (Kienberger et al., 2013); to create an interactive and user-friendly geographical interface aimed at assessing primary care performance ratings (Boulos, 2004); for publishing health maps and connecting to remote Web Map Service (WMS) sources to represent and share useful geo-spatial information, data and images in an effective way (Boulos and Honda, 2006).

These possibilities are increased by specific extensions and functionalities that can provide considerable benefits in the field of geographical health education. For example, apps such as "Survey123" for ArcGIS⁷ make it possible to submit geolocalized questionnaires which can rapidly involve a huge number of people from anywhere at all and according to a user-friendly structure. It is a digital solution that helps to capture and record information at any time and from anywhere, producing an orderly data collection directly available and processable in a GIS platform for a graphic and cartographic representation and deeper analysis. On the other hand, geocoding services with ArcGIS⁸ make it possible to convert addresses into coordinates, to turn coordinates into addresses, to identify hot spots or to locate copious sensitive facilities or ones exposed to risk. In a GIS platform, highly effective 2D and 3D visualizations of multiple and related variables can be created.

The importance also has to be underlined of introducing WebGIS into public health education in schools which – in a horizontal and vertical cooperative and stimulating environment – offers much promise for learning as it can be thought and designed for proactive digital map utilization, thereby mobilizing and increasing student awareness to a better understanding of health both at local and global levels. It enables students

⁷ For an overview and specific information, with the possibility to make a free subscription for 21 days, see https://www.esri.com/en-us/arcgis/products/survey123/overview.

⁸ For a general framework and some examples see https:// developers.arcgis.com/features/geocoding/.

to nurture critical and spatial thinking in a diachronic key, in order to have increased knowledge of the future problematic scenarios and to incorporate useful mental modeling into their educational process (Reed and Bodzin, 2016, pp. 6317-6318)⁹.

It has also been affirmed that (Baker, 2015, p. 114):

The capacity for webGIS to support educational priorities like STEM [Science, Technology, Engineering, Mathematics] and career readiness, instructional practices like Project Based Learning and constructivism, and overcome previous technical issues like data scale, size, and complexity all add to the advancement of webGIS in education. [...]. The influences of webGIS will, if it hasn't already, change the landscape of geographic and science education in schools and universities around the world.

Further captivating perspectives are opened, in a profitable process of geographical health education, by the possibilities offered by story maps and digital storytelling which make it possible to give space to creativity within an environment of (space-time) representation that maintains strict criteria of data and image restoration. It is possible to elaborate very incisive story maps focused on different topics of health, by choosing among the different available templates, according to the aims of the applications and on the basis of the documents which students (coordinated by the teachers) desire to enhance. After having produced their conscientious story maps, students can share them by the web in an atmosphere of colourful enthusiasm, activing a circuit of shared applications that can act as a stimulus for similar experiences. It also permits them to use and test a new way to document, moving towards a particular form of digital geographic journalism which pushes to integrate different kinds of maps, photos (also shooting during field surveys) and texts in a pre-structured harmonious template.

From a didactical point of view – using geotechnologies and similar GIS applications, where geography, interdisciplinary approach and specific geo-tools are synergically connected to pursue goals of community usefulness - it makes possible to move towards enterprising actions, as for example to (Pasquinelli d'Allegra, 2016, pp. 55-60): organize and animate learning situations in an innovative way; manage and finalize (on contingent problems) the progression of learning; engage and inspire in an active learning process, starting from the cooperative learning and arriving at the flipped classroom; encourage working group strategies also through common projects and elaborations; support the profitable conjunction between applied research and laboratory didactics; use geotechnologies for stimulating critical approaches and translate theoretical contents into concrete skills; promote an active citizenship, in a transcalar perspective.

All these represent a founding nucleus, focussing the attention on aspects related to health, quality of life, correct behaviour to adopt and the respect for inequalities.

In this way and with the support of various social networks, it is also possible to think of spreading guidelines and recommendations through immediate and vivid modalities that can help to reach remarkable goals, involving a huge audience, according to shared and regulated planning. Health education also needs to pass through ad hoc awareness campaigns that – enhancing the involvement capacity of GIS and geotechnologies web applications and the impressive use of social networks – can help to rectify incorrect behaviour and to reduce preventable causes of disorders and deaths, efficaciously acting on risk factors right from childhood and adolescence.

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⁹ Lesson series supported by geotechnologies seem to significantly concur to the development of students' spatial and relational thinking, also supporting interdisciplinary approach and proactive interactions (Favier and van der Schee, 2014).

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Comparing learning geography with ArcGIS online and desktop

Ali Demirci^a, Ahmet Kraburun^b, Serdar Arslan^c

^a Commission on Geographical Education of the International Geographical Union (IGU)

^b EMİ Grup Bilgi Teknolojileri A.Ş., Istanbul, Turkey

^c Marmara University, Istanbul, Turkey

Email: dmrc.ali@gmail.com

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Abstract

To evaluate the use of different GIS platforms for learning geography this study presents the results of an experiment in which lessons with a desktop GIS and an online GIS are compared. Students from four secondary schools participated in geography lessons about global and Turkish earthquake risks using GIS. Of a group of 172 students 84 students used ArcGIS desktop software and 88 students used ArcGIS online. The results of the comparison in a pre-test post-test experiment show the online version to be more effective, but the results are not unambiguous. A questionnaire used to understand students' attitudes after the lessons and GIS platforms showed that most students were positive about the online version as well as the desktop version. In reaction to survey statements on the GIS platforms the WebGIS group scored more positively than the desktop GIS one. Although unfortunately this investigation could not be carried out in a classroom setting it may help the discussion on using GIS platforms in secondary education and inspire further research.

Keywords: Desktop GIS, Geography Education, Secondary Schools, WebGIS

1. Introduction

Although GIS has been gradually spreading around the world, its use in teaching and learning different subjects in schools remains unsatisfactory in many countries (Doering and Veletsianos, 2008; Kim et al., 2011; Roulston, 2013). Kerski et al. (2013) addressed this by indicating that GIS has not even become a commonly used teaching tool in the US and the UK where the use of GIS in education was pioneered more than two decades ago. This slow rate of utilizing GIS in schools has been attributed to a number of hardware, software, pedagogical, and administrative challenges (Baker, 2005; Bednarz and Audet, 1999; Kerski, 2003; Bednarz and Van der Schee, 2006; Milson and Kerski, 2012). The challenges vary from country to country but are often related to GIS software. A lack of financial resources to obtain and upgrade software and digital data, difficulties in installing software, a lack of school IT and administrative support, and lack of opportunities for teachers to learn software are among others cited in different studies (Baker, 2005; Harris et al., 2010). Most important of all is that from the start the available GIS software was *desktop GIS* developed for uses in science, business, and industry. Its interface and tools were not designed according to the needs of teachers and students. Therefore, they are difficult to use in teaching and learning (Bednarz, 2004; Bednarz and Ludwig, 1997; Favier and Van der Schee, 2012; Liu and Zhu, 2008; Harris et al., 2010). A desktop GIS is installed and operates on a personal computer. Users can only display, update, query and analyze geographic data locally. A desktop GIS is not accessible on a server or externally, therefore limiting access to how and where it can be managed. With its complex tools and functionalities, desktop GIS software takes quite a long time for teachers to learn. However, time is what teachers usually lack resulting mainly from strictly controlled and overloaded curricula and the emphasis on increasing student scores from standardized tests.

Without proper and carefully designed strategies the complex nature of GIS software may divert students' attention from lessons to technology, therefore having the potential to affect students' learning negatively (Baker and White, 2003; Manson et al., 2014). Over the years the advancements in science and technology have made GIS software more user friendly and more easily available to teachers. However, GIS software related barriers still hinder the incorporation of GIS into secondary education, although teachers around the world find them less problematic compared to the past (Baker et al., 2009).

The combination of the great educational potential of GIS technology with the difficulties of using it for teaching and learning resulted in a recognized need for better approaches to the adoption of GIS in schools (Henry and Semple, 2012). Initially, user friendly GIS desktop software packages were developed specifically for educational purposes and with much less complex interface and tools, mainly by relying on existing professional GIS software. Urban World, designed to foster students' progress towards a better understanding of the urban environment, is one of these examples, and was developed as an ArcView application in the US of the 1990s (Thompson et al., 1997). Although being useful for educational purposes, these software packages were few in number and could not attract widespread attention due to their limited contents and capabilities for spatial query and analysis (Liu and Zhu, 2008).

Α real new perspective came with advancements in the Internet technology. Internet provides users with an alternative solution to a desktop GIS, offering WebGIS with the flexibility to work remotely and more interactively. This also opened up opportunities to tackle the majority of software related problems in utilizing GIS technologies in schools for educational purposes. After emerging as a promising technology by combining the power of the Internet and desktop GIS software in the 1990s, WebGIS provides teachers and students with a wide range of applications to display, visualize, query and analyze geographical information over the Internet.

Desktop GIS offers more functionalities and possibilities than WebGIS to analyze problems using digital maps. Although various WebGIS platforms offer many versatile benefits for teaching and learning, most of them have limitations especially for spatial analysis. Named atlas-style WebGIS by Baker (2005) these platforms are effective in data visualization and simple queries, but are not very qualified in data analysis. For example, PaikkaOppi, the very successful WebGIS platform used in Finland, has tools for spatial analysis, such as proximity, modeling, or buffering, but they are extremely marginal and limited only to the visual (Riihela and Maki, 2015). This kind of constraints does not cause big problems, especially when the GIS applications in schools are conducted based on some basic visualization tools and queries. However, if WebGIS platforms are to be used with project based approaches, then advanced geospatial analysis such as interpolation and the calculation of density may be necessary (Demirci, Karaburun and Ünlü, 2013). Advanced geospatial analysis methods and tools are major parts of desktop GIS software which are therefore popular business and government. However, in researchers see WebGIS as a powerful alternative for successfully incorporating GIS in education by removing many traditional barriers associated with desktop GIS (Baker, 2005; Henry and Semple, 2012; Milson, 2011; Riihelä and Mäki, 2015). Being available online 24/7 and its presumed ease of use, mainly resulting from its simple interface and tools, are the main advantages of using WebGIS for teaching and learning. Using WebGIS reduces software costs and negates software installation issues and extensive work with IT staff in schools (Kerski et al., 2013).

Many WebGIS applications have been developed and used in education especially over the last two decades. While various studies have explored how effective WebGIS would be in applying constructivist learning approaches in classrooms such as project based, inquiry based, collaborative, exploratory, and inductive learning (Bodzin and Anastasio, 2007; Henry and Semple, 2012; Huang, 2011; Milson and Earle, 2007), others have focused on how these platforms affected students' skills such as spatial thinking and reasoning, relational thinking, and spatial decision making (Bodzin et al., 2015; Carver et al., 2004; Favier and Van der Schee, 2014). WebGIS platforms have been tested in education as either standalone technology or with other web-based platforms such as Google Earth (Bodzin and Anastasio, 2007). The availability of a simpler WebGIS has facilitated the use of GIS in classrooms after many years of a more professional desktop GIS.

As explained by Manson et al. (2014), there is little research evaluating the usability of various GIS platforms and identifying the most important barriers to their effective use in classrooms. Studies conducted so far have focused on the use of GIS in education used web platforms designed either with professional GIS software tools like ArcIMS or open sources. However, studies evaluating the effectiveness of different GIS platforms offered by professional GIS software companies like the Environmental Systems Research Institute (ESRI) are scarce. Since the majority of the GIS applications in schools around the world are carried out by using the GIS software produced by professional GIS companies (Baker et al., 2009), and GIS platforms are in constant development, there is a need to understand the potential of these web platforms for teaching and learning. Evaluating the usability and effectiveness in education of online and desktop GIS will help to understand how these rapidly changing technologies can be used to support teachers and students to use them efficiently and easily in classrooms. This study sets out to contribute to that aim by evaluating the usability of GIS for teaching and learning by comparing the use of two ESRI platforms, ArcGIS online and ArcGIS desktop, in secondary geography lessons.

2. Method

Secondary education in Turkey covers the education of children between 15-17 for at least three years after primary education. Geography is part of the secondary curriculum. In this study two GIS exercises were developed for the first year of secondary geography, so the average age of the students was 15. The exercises were used at four secondary schools in Istanbul, Turkey. The GIS exercises were carried out by two groups of students from each school; one group with desktop GIS and the other group with WebGIS in a computer laboratory. Tests were administered before and after the exercises to understand how desktop and online GIS platforms affected the students' achievements. The students were also presented with a survey at the end of the exercises to assess what their feelings and thoughts were about the two GIS platforms and the overall GIS exercises. The details of the methods used in the study are given below.

2.1 Development of the GIS exercises

Many themes in geography lessons in different grades focus on the understanding of space and spatial relationships and are suitable to being taught by GIS. This is also true for one of the main objectives of secondary school geography curriculum in Turkey: understanding why earthquakes happen and what risks they create in the world and in Turkey. In this study GIS exercises were used to teach students why earthquakes take place in association with the plate tectonics and what the earthquake risks are in the world and in Turkey.

As one of the commercial GIS software suppliers with desktop as well as online GIS software, ESRI products ArcGIS desktop 10.1 and ArcGIS online were used in the study. GIS data for the exercises were obtained from the book 'GIS for Teachers' written by the first author of this paper and published in Turkish with support from ESRI Turkey. The first GIS exercise named "which regions are tectonically the most active in the world?" intended to introduce basic plate tectonics, plate movements, earthquake locations, and risks around the world. The second GIS exercise named "why does Turkey often experience earthquakes?" aimed at providing students with an understanding of the earthquake risk in Turkey in association with the faults and historical earthquake data.

In order to implement the exercises with the desktop GIS, all the data were grouped, classified, and properly arranged as two separate ArcMap documents for the two GIS exercises so that students would be able to start the exercises with only a mouse click. The same data were transferred to and grouped in the ArcGIS online platform with their attribute information as two different applications for implementing the same two exercises with WebGIS. Student application documents for each exercise were prepared as Microsoft Word documents to allow students in desktop and online GIS groups to follow the exercises at different stages. The application documents were also used as lesson plans for each exercise and provided students with a detailed guidebook to understand why and how they would take steps in the exercises and which questions they would seek to answer at different stages. The learning activities identified at each stage of the exercises were designed for students to examine spatial patterns and relationships among the data presented as different layers.

The first GIS exercise concerning earthquakes in the world consisted of six stages. The first two stages focused on the analysis of the earthquakes with their location and magnitude. The third and fourth stages aimed to understand the location and types of volcanoes around the world. In the fifth stage students were given an unlabeled world map on the exercise document and asked to draw the plate boundaries by examining the location of the earthquakes and volcanoes. In the sixth stage the students were asked to add the plate boundary data to their GIS platform and compare the original data with the ones they drew. The last stage was designed to allow students to analyze the relationship between plate boundaries, earthquakes, and volcanoes and the earthquake risks in specific countries and across the world. The exercise document included 13 questions asked at different stages.

The second GIS exercise concerning the earthquake risks in Turkey also consisted of six stages. The first stage focused on the analysis of the earthquake locations in Turkey and its close vicinity. The analysis of the relationship between earthquake locations, landforms and faults in Turkey was targeted in the second stage, while the earthquakes in Turkey between 1995 and 2005 were explored with their magnitude and dates in the third stage. The major earthquakes in Turkey between 1903 and 2004 were analyzed in the fourth stage with their location, date, magnitude, and effects. In the fifth stage the students were given an unlabeled map of Turkey on the document and asked to draw the first degree earthquake risk zones of the country by investigating the location of earthquakes and fault lines. In the last stage the students were asked to add the earthquake risk zones of Turkey to their GIS platform and analyze the earthquake risks in particular cities, provinces, and regions across the country. The second GIS exercise document included 19 questions asked at different stages.

2.2 Implementation of the GIS exercises in geography lessons

The GIS exercises were implemented with 172 ninth grade students from four high schools in Istanbul, Turkey. One of the public schools involved in the study is a social science high school which is very successful in students' achievement at university entrance exams. This school is called school A in this study. Only one private high school, school B, participated in the study, which is a science high school. The other two public schools were an Anatolian vocational high school (school D).

The schools that took part in the study were chosen so as to observe how the overall GIS exercises would be performed in different types of schools having a slightly different school curriculum, physical setting, financial resources, and achievement level. School A has more diverse and intense social science courses, while school B is just the opposite and favors science courses. School C is a general high school providing a holistic approach with a combination of sciences and social sciences, while high school D favors a great number of technical courses. Being one of the main social science courses in secondary schools, geography is a mandatory course in the 9th grades of all these schools with almost the same curriculum. As prior knowledge of GIS of students was not the focus, this study was conducted with 9th grade students.

Two groups of students were selected at each school, with the help of the geography teachers. One group of students was the desktop group implementing the exercises with ArcGIS desktop software, the other group was the online group carrying out the same exercises with the ArcGIS online platform in each school. The overall school performance of the selected students was as far as possible of equal achievement level. As the study did not aim to analyze gender effects, the selection of students did not take account of even numbers of boys and girls in both groups.

Computer laboratories equipped with a sufficient number of computers and high-speed Internet connection were the necessary infrastructures to implement the exercises at schools. However, computer and Internet conditions were not sufficient enough at all the chosen schools to implement the exercises successfully, therefore the GIS desktop and online exercises were carried out in a GIS laboratory at Fatih University in Istanbul. The desktop and online groups from the same school implemented the exercises at different times, before and after noon on the same day without any possible interaction between the two groups of students. The study aimed to analyze the effect of the use of desktop and online GIS in geography lessons. Therefore, the students' level of understanding, grades, materials, durations, and topics of the exercises were the same with only one exception being the platform that the exercises were implemented on.

The students who took the exercises did not have any prior experience withGIS software and therefore needed to gain a basic understanding of GIS and the platform that they would use during the exercises. The overall experiment with each group of students lasted four sessions, about 50 minutes each with ten-minute breaks in the laboratory. In the first session students were introduced to the history, functionality, uses and benefits of GIS accompanied by a Power Point presentation. The aim and detailed plan of the overall study that the students would be involved in were presented in detail. The pre-tests to measure the students' achievements with GIS were then administered. In the second session students were introduced to the GIS platform that they were to use in the exercises. The desktop group used the ArcGIS desktop GIS to get to know its basic tools and functions, while the online group was first taught how to obtain a free trial license and then introduced to the ArcGIS online with its basic tools and functions that they would use during the exercises. In the third and fourth sessions students implemented the two GIS geography exercises by using the given GIS platform (Figure 1). After the exercises the posttests were administered with the same questions as those used in the pre-tests. Finally, the students were given a survey to collect their opinions about the GIS exercises and platforms used.

Students were given their exercise documents and asked to follow the steps which were taken by the lecturer on the master computer and shown by a beamer. Each student was given a separate computer. Students were told to work alone and asked to answer the questions given in the exercise documents. The geography teachers of the students attended the experiment and helped the students where necessary.



Figure 1. The students implementing the GIS exercises (a) control group with ArcGIS desktop, (b) experimental group with ArcGIS online.

2.3 Evaluation of the data

The usability of the WebGIS platform used in the study was mainly identified through the observations made and difficulties faced during the preparation and implementation of the GIS exercises. The effects of using desktop and online GIS platforms on students' achievements were measured by the analysis of the pre- and posttests performed before and after the exercises. The pre- and post-tests included the same ten questions, five for each GIS exercise.

An unlabeled world map was given to the students in the first section of the test regarding the earthquakes in the world. In the first two questions the students were asked to mark the regions across the world experiencing major earthquake and volcanic activities. The students were asked in the third question to draw the main plate boundaries on the map with lines. The fourth question was asked to understand what the students knew about the relationship between earthquakes, volcanoes and plate boundaries, while in the fifth question the students were asked to name five countries where frequent major earthquakes are experienced.

The second section of the pre- and post-tests included an unlabeled map of Turkey with the provincial boundaries and contained five more questions. In the first question of this section the students were asked to mark the regions experiencing frequent earthquake activities in Turkey. In the second question the students were asked to draw the main fault lines over Turkey. The names of the five provinces where the risk of earthquake is highest and lowest were asked respectively in the third and fourth questions and in the fifth question the students were asked to explain why Turkey has been experiencing many earthquakes with various magnitudes every year. The students' scores from each test were calculated out of 100 by giving 10 points to each of the 10 questions. The scores of the pre- and post-tests were compared and statistically analyzed to determine which GIS platform led to better student performance over the other. A paired sample t-test was used to identify whether the students' scores differed significantly from the pre-test to the post-tests in both groups. An independent t-test was also used to compare the average pre-test and post-test scores of the students between the desktop and online groups.

Another goal of this study was to understand the students' attitudes towards the GIS exercises and the platforms used. A survey of 12 questions in three sections was used for this purpose after the GIS exercises. The first section contained three personal questions to identify the gender, school, and grades of the students. The second section included four questions and was designed to understand the students' knowledge and experiences with GIS prior to the exercises. The third section included Likert scale and openended questions. The two open ended questions in the survey asked the students to identify the difficulties they faced during the implementation the GIS exercises and to provide of recommendations in order to carry out similar GIS exercises more effectively in the future.

The first Likert scale question included 10 statements about the overall lessons that students took with the GIS exercises, the second Likert scale question contained nine statements regarding the GIS platform used. In the Likert scale questions students were asked to determine their level of acceptance by marking strongly agree, agree, neutral, disagree or strongly disagree. The statements of each Likert type question can be found in Tables 4 and 5 in the result section of this paper together with the students' responses. The internal consistency of the statements in these Likert scale questions was measured by Cronbach's alpha separately for the desktop and online groups. For the 10 statements of the first Likert scale question Cronbach's alpha showed a reliability at 0.917 for the desktop group and at 0.828 for the online group. In the second Likert scale question the internal consistency of the nine statements was calculated with Cronbach's alpha as 0.790 for the desktop group and as 0.752 for the online group. The students' opinions about GIS and its use in education were obtained by another Likert scale question containing six statements. The internal consistency of these statements was calculated with Cronbach's alpha as 0.719 for the desktop group and 0.695 for the online group.

3. Results

As shown in Table 1, 90 male and 82 female students participated in the application. There were small differences in number and big differences in gender between the schools. In school B, the private school, all participants were male but almost three-quarters of the participants from school D were female. Male and female student ratios were more balanced in schools A and C.

Schools	ArcGIS desktop		ArcGIS online			Total			
	М	F	Т	М	F	Т	М	F	Т
Α	10	9	19	7	13	20	17	22	39
В	19	0	19	22	0	22	41	0	41
С	12	11	23	8	15	23	20	26	46
D	7	16	23	5	18	23	12	34	46
Total	48	36	84	42	46	88	90	82	172

M: Male, F: Female, T: Total

Table 1. The number of students who implemented the GIS exercises.

Test / Group		Ν	Mean	Std. Deviation	t	df	р
Paired Sample t test			-			-	
Desktop GIS		84	-32,214	16,525	-17,867	83	,000
Online GIS		88	-25,091	13,018	-18,081	87	,000
Independent Sample	t-test						
Pre-test	Desktop GIS	84	25,14	12,089	1,559	170	,121
	Online GIS	88	22,34	11,488			-
Post-test	Desktop GIS	84	57,36	16,290	4,305	170	,000
	Online GIS	88	47,43	13,899			

Table 2. Analysis of the significance of the test scores.

Students were asked four questions about their prior knowledge of GIS and their experience with GIS. The students were first asked whether they had heard of GIS before taking part in this project. Only 28% of the students responded yes to this question, but the responses were different from school to school: 33% of the students from school A, 50% from school D, 17% from school B, and 11% from school C had heard of GIS. The students were also asked whether they had used a GIS software before and those who answered yes to this question were asked what software they used. Only three students from school D reported that they had used a GIS software before without giving any software name.

3.1 The effects of the GIS exercises on students' achievement

The tests administered before and after the geography lessons with GIS provided an

understanding of how the two GIS platforms affected the students' achievements from the lessons. The paired t-test applied over the test scores of the desktop and online groups of the students from four schools showed statistically significant differences (p < 0.05) from the pre- to the post-test scores (Table 2). The independent sample t-test shows no statistically significant difference between the pre-test scores of the desktop and online groups (p < 0.05). However, as seen in Table 2, the same test results indicate statistically significant difference (p < 0.05) over the post-test scores of the desktop and online groups. This result reveals that the students who implemented the exercises with the desktop GIS software were more successful than the students who carried out the same exercises with WebGIS, based on their post-test scores.

Schools	Ar	cGIS deskto	р	ArcGIS online			
	Pre-test (Average)	Post-test (Average)	Increase (%)	Pre-test (Average)	Post-test (Average)	Increase (%)	
Α	32.3	60.8	88.2	29.7	60.3	103	
В	24.7	53.8	117.8	17.8	39.6	122.5	
С	26.0	52.6	102.3	17.1	43.6	155	
D	18.7	62.2	232.6	25.5	47.6	86.7	
Total	25.1	57.4	128.7	22.3	47.4	112.6	

Table 3. The pre- and post-test scores of the students.

Table 3 shows the students' scores in the pretests and post-tests. Desktop and online groups received on average 25.1 and 22.3 points out of 100 from the pre-tests and an average 57.4 and 47.4 points out of 100 from the post-tests. The pre-test and post-test scores differed considerably among the schools. Table 3 also shows the average progression between pre-test and posttest. This increased in the desktop and online groups by 128.7% and 112.6% respectively. The progression in points of all students in the desktop group is 127.7 points and 91.0 points in the online group. The difference is 36.7 points, but if we delete school D this difference is only 5 points. The impact of school D is obvious. Remarkable and not easy explainable is the big progression of school D in the desktop group and the below average progression of the online group in school D.

3.2 Students' opinions about the exercises, GIS platforms, and GIS

At the end of the experiment the students completed a survey to obtain their opinions about the exercises, GIS platforms used and GIS in general.

The Likert scale statements about the different exercises in the experiment and students' responses to each statement are displayed in Table 4. The strongly agree and agree sections were grouped as positive responses, the strongly disagree and disagree options were classified as negative responses.

Table 4 reveals that the vast majority of students in both groups were positive about all the statements. The students in the desktop group were somewhat more positive than the online group in 7 of the 10 statements in Table 4. Most students in both groups found the exercises interesting and entertaining. Over 85% of the students in both groups found the tools, materials, and methods used in the exercises successful. while the same number of students considered the exercises helpful for understanding the geography lesson. Over 80% of the students in both groups could follow the exercises without difficulty. Some statements give a clue about the students' overall satisfaction with the GIS exercises. One of these statements says, "I followed the exercises without getting bored". Two out of three students (strongly) agreed with this statement in both groups.

The Likert scale questions of the survey about the GIS platform used are presented in Table 5. This table consists of five items with a positive statement agreed with by the majority of the students and four items with a negative statement disagreed with by the majority of the students. The percentage of positive reactions on the first five items and the percentage of negative reactions on the last four items is higher in the online group than in the desktop group.
Table 5 shows that the majority of the students in both groups reported the visual interface to be pleasant (over 78%), and the tools and buttons usable and understandable (over 71%). Many students in both groups also agreed that they learned to use the software with its basic tools (over 82%) and think that they will be able to carry out similar exercises on the same platform easily (over 78%). Over two thirds of the students in both groups were positive about the smoothly running software. Table 5 also shows that although the language of the GIS platforms was English, only 18% of the students in the desktop group and 16% of the students in the online group reported the language to be an obstacle to learning the tools of the platform. For most students, software use did not overrule students' attention for the geography exercises.

Table 6 presents students' opinions about GIS. The majority of students in both groups agreed or strongly agreed with the six statements. More than 80% of the students in both groups agreed that GIS makes students learn by doing and therefore supports effective learning. Over 70% of the students agreed that GIS should be used in geography lessons as an educational tool.

Statements		Positive Responses		Neutral responses		Negative Responses	
		Online	Desktop	Online	Desktop	Online	
The exercises were useful to get to know GIS and its uses	96.5	94.3	2.3	4.6	1.2	1.1	
The exercises were helpful for understanding the lesson	91.8	89.8	2.4	6.8	5.8	3.4	
My overall performance during the exercises was sufficient	91.7	85.2	4.7	12.5	3.6	2.3	
We were given enough time to implement the exercises	88.2	84.1	5.9	10.3	5.9	5.7	
The tools, materials, and methods used in the exercises were successful	85.9	93.2	9.3	4.6	4.8	2.2	
The exercises made the lesson entertaining	81.2	77.3	7.1	18.2	11.7	4.5	
I could follow the exercises without difficulty	81.2	86.3	10.5	10.3	8.3	3.4	
The exercises were interesting	77.7	84.1	12.9	8	9.4	7.9	
I liked the exercises very much. If only all the lessons were conducted like this	72.9	65.9	15.3	23.9	11.8	10.3	
I followed the exercises without getting bored	65.8	64.8	18.8	26.2	15.4	9	

Table 4. The students' opinion about the exercises.

Statements		Strongly agree or agree		Neutral responses		Strongly disagree or disagree	
		Online	Desktop	Online	Desktop	Online	
I learned how to use the software with its basic tools	82.3	92	9.4	4.5	8.2	3.4	
The visual design of the interface was pleasant	78.8	80.7	5.9	11.3	15.3	8	
I believe that I will be able to carry out similar exercises on the same platform easily	78.8	85.2	11.7	11.4	9.5	3.4	
The tools/buttons on the platform were usable and understandable	71.8	88.6	15.3	6.8	12.9	4.5	
The software was running fast and smoothly, I didn't have to wait while it was processing	70.3	68.2	15.5	14.7	14.2	17.1	
The language of the platform was an obstacle for me to learning its tools	17.6	15.9	18.8	10.2	63.6	73.9	
There were many tools and buttons on the software. They distracted my attention.	16.5	10.2	15.3	15.9	68.2	73.9	
The GIS platform was very technical, so I had difficulty in understanding and using the software	11.8	11.5	17.6	14.9	70.6	73.6	
I could not pay enough attention to the exercises, because I was trying to understand how to use the software	9.4	8	14.1	10.2	76.5	81.8	

Table 5. The students' opinions about the GIS platform used for the exercises.

Statements	Positive Responses		Neutral responses		Negative Responses			
		Online	Desktop	Online	Desktop	Online		
GIS makes students learn by doing; therefore supports effective learning	92.9	87.6	4.7	11.3	2.4	1.1		
GIS has not been properly utilized in secondary school geography lessons in Turkey	87.1	84.1	9.3	10.3	3.6	5.6		
GIS increases students' success in geography lessons	82.4	88.6	12.9	8	4.7	3.4		
GIS should be used in geography lessons as an educational tool	80	73.8	16.5	20.5	3.5	5.7		
The potential of GIS for geography lessons is not adequately known in Turkey	80	79.5	14.1	13.6	5.9	6.8		
I want to know GIS better and benefit from it	77.7	79.6	16.5	15.9	5.8	4.5		

Table 6. The students' opinions about GIS.

3.3 Students' reactions to the open questions

All these positive reactions to using GIS do not mean that the students did not have any problems during the exercises. In an open question at the end of the survey the students were asked if they had any difficulty in the entire application process. In the desktop group 38% of the students and in the online group 15% indicated that they had encountered problems during the exercises. The students who indicated that they had difficulties during the exercises were asked to provide details of the difficulties. The difficulties expressed most frequently were related to the exercises: 18 students in both groups said that the exercises

were too long, difficult to follow or boring and 16 students in both groups had difficulties regarding the software and hardware. The language of the software was expressed as a difficulty by 10 students in both groups and another 10 students expressed difficulties regarding the interface of the platform (the tools and buttons were too complex to use).

In another open question the students were asked to provide recommendations for carrying out similar exercises more efficiently in the future. Reactions came from 27 students in the desktop and 19 students in the online group. The biggest group of recommendations were made about the software: 30 reactions said that the software should be made simpler, more attractive, faster, easier and more entertaining. Ten recommendations in both groups focused on the exercises that were too long and needed more interaction between students and lecturer.

4. Conclusions

In line with previous studies (Kerski et al., 2013; Lee and Bednarz, 2009; Lemberg and Stoltman, 2001) this study revealed that desktop and online GIS lessons help to increase students' achievements and interest in geography lessons. As Table 3 shows, the average scores of the students in both groups increased more than 100%. The differences between the desktop GIS and WebGIS group in this experiment are in favor of the desktop group. A closer look at the four participating schools reveals that one of the schools has a strong impact on these results which cannot easily be understood. Looking at the pre- and post-test progression (Table 3) we noted that the desktop group was more successful than the online group. However, when the average test scores were analyzed by schools, a different picture appeared. Only at school D did the desktop group increase its average score more than the online group. The three other schools had low pre-test scores in the online groups which may be part of the explanation for the bigger progression in the online groups in these schools. Further research is necessary to explain the special position of school D and especially the considerable progression of its desktop group.

In addition, this study shows that the students' attitudes to the exercises. GIS platforms, and GIS were positive in both groups. The vast majority of the students found the overall lesson very interesting, useful and entertaining and considered the GIS platform they used for the exercises pleasant and easy to use. With these results the study shows that ArcGIS desktop and ArcGIS online both seem to have a great potential for teaching and learning geography in secondary schools. This study did not show a clear difference between the students' opinions in both groups on overall exercises and GIS as a technology. However, the students' opinions about the GIS platforms they used differed between the groups (Table 5). The students in the online group found the GIS platform less complex, somewhat more usable and more understandable than their counterparts in the desktop group. This is consistent with the findings of other studies that WebGIS platforms have simple interfaces and tools and are thus more user friendly and less intimidating to use than desktop GIS software (Baker, 2005; Henry and Semple, 2012).

The study learns that both GIS platforms have potential to be used in secondary school geography lessons as an educational tool. It was a pity that the experiment could not be made in a school class but only in a university GIS laboratory. Further research should try to realize a classroom setting in more comparable schools with students' own geography teachers as instructors. However, using GIS in classrooms is not without challenges. The preparation of GIS lessons is not always easy. In this study the researchers invested a lot of energy and time before the exercises could be started. The key question in understanding a successful incorporation of GIS platforms into geography classrooms seems to be: to what extent will teachers be willing to spend time and energy to use GIS platforms in lessons successfully? Unless we provide teachers with more time and resources, we are not likely to see desktop GIS or WebGIS as a common tool in classrooms in the near future, no matter how advanced and sophisticated the platforms are.

Although the effect of working with desktop GIS or WebGIS in this study was not pronounced, this study gives some support for the idea that WebGIS is easier to handle in education than desktop GIS. For both GIS platforms it is important to develop teacher proof and student proof versions. To solve many software related problems of GIS platforms in schools, professional GIS software companies need to be encouraged to develop platforms by taking teachers and students' needs into consideration. Recommendations for developing GIS platforms for schools should include the next focus points: easy access, user friendliness, attractive by offering huge amounts of updated data and analyzing tools as well as information about different user strategies. Last but least the success of learning with GIS stands or falls with teacher training (Lay et al., 2015). The pedagogical use of GIS platforms should be emphasized especially for teaching with GIS in K12 education, while the teaching about technology should be minimized (Henry and Semple, 2012).

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A GIS-based fuzzy analysis for mapping the touristic potential in Lazio Region (Italy)

Andrea Spasiano, Fernando Nardi^a

^a Water Resources and Research Documentation Center, University for Foreigners of Perugia, Perugia, Italy Email: andrea.spasiano@unistrapg.it

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Abstract

Sustainable tourism is a key function for socio-economic development in Italy. Identifying cultural heritage, environmental, landscape resources, processes and features is one of the most important strategies for sustainable and efficient urban planning and management. The Italian jurisdictional framework defines regional plans by means of specific laws that govern zoning procedures and regulations with operational guidelines and constraining conditions for urban planning. While urban and land development is the subject of several regionally mapped governing and zoning plans, tourism is often locally regulated, and a national tourism plan is still in a phase of initial implementation. As a result, spatially distributed regulatory and management information regarding the economic, social and cultural value of tourism at the country scale are not available. This research proposes and tests an experimental GIS methodology for mapping the touristic potential using open geo data developed by means of using a quantitative index. The spatial distribution of the tourism potential index presented is based on two main input parameters: landscape diversity and drive-time accessibility from a central mobility location. The first parameter defines the local attractiveness, the second the potential fruition of touristic resources. The Lazio Region, in central Italy, is selected as case study for its rich and heterogeneous landscape heritage, in most cases spread around its internal - not easily accessible - areas. Available geographic data are gathered and processed by means of spatial analysis techniques, in order to obtain numerical values, subsequently classified by GIS-based fuzzy logic measures. Results show a homogeneous map of index-based local destinations' attractiveness, based on easy understandable value-scale, that shall be used as a support decision and policy making tool.

Keywords: Decision Making, Fuzzy Analysis, Landscape, Planning Tourism

1. Introduction

Italy has one the richest tourism economies in the world because of the abundance of places that owing to their endogenous characteristics, endowment of cultural resources, represent peculiar and varied attractions for tourists (Benassi and Spadoni, 2003). Cultural and environmental heritage, landscape, historic cities and the diversity of Italy's geography represent a unique factor of competitiveness and international tourist attractiveness, especially in the cultural declination of the sector (Prezioso, 2007; Gemmiti, 2012; Mangano, 2018). The attractiveness of cultural tourism in Italy depends on its peculiar landscape features, which integrate environmental and morphological aspects with historical and settlement values. These factors support the continuous diversification and innovation of the tourism offer from the national and to the local level (Reggiani, 2010). The value of Italy, linked to cultural tourism, is quantified by the 2014-2015 Country Brand Index (Mangano, 2018). The ENIT¹ Triennial Plan 2016-18 has also identified the fundamental elements in the cultural and environmental heritage empowering the tourism sector in Italy at local level and in marginal areas (ENIT, 2016).

National legal instruments protect the attractive Italian features defining local landscapes and cultural assets to be preserved up to the regional scale of territorial plans. Recognition and identification of areas and elements to be protected represent a necessary preliminary phase of planning strategies supporting critical management of socioeconomic activities².

Operational programs and tools – like the Strategic Touristic Plan (PST) 2017-2022 and the Internal Areas Strategy – are based on the principle that natural and cultural resources are fundamental assets for touristic and recreational purposes, according to strategies of social and environmental sustainability. These are pivotal elements of the revitalization processes of cities and local territories, laying the foundations for rethinking and innovating local socio-economic structures (Morelli, 2003; Gemmiti, 2012). These principles have been developed by the European Landscape Convention, stating that the promotion of territory for tourist purposes leans on the vast and variegated cultural and natural heritage and also on landscape and its peculiar structures (European Convention, 2000).

These strategic guidelines provide new functions to cultural heritage and landscape, as essential resources for the financial recovery of local territories (Cicerchia, 2003). Cultural heritage and landscape become non-relocatable attractors, contextualized and distinguishable original environmental from the context (Cicerchia, 2003; Prezioso, 2007). Therefore, they are at the base of the territorial planning government processes. design and as frameworks of future prospects for territory and local economies (Dematteis, 1998; Governa, 1998). Cultural and environment assets can thus be considered, from an economic-business perspective, as a symbiotic substratum that gives added value to local development processes (Catturi et al., 2003). Anyway, other many contribute to local tourist factors can development. Factors that play a supporting role for the enjoyment of landscape and tourist services. Cultural and environmental assets become strategic for the tourism sector when connected with other support factors such as services and accessibility, that represent competitive benefits for the territory (Gemmiti, 1999, 2010; Celant et al., 2003).

Geographical marginality is often a limit to the tourist valorization of many Italian internal varied attractiveness. despite their areas. Marginality therefore represents a key to understanding the regional imbalances of the Italian economic and tourism system (Celant, 1999; Celant et al., 2003). Starting from the 80s, the structural changes of the Italian economy have imposed a reflection on the new models of territorial development at the local level (Celant, 1994). In this new vision cultural tourism plays a strategic role in the local economy (Morelli, 2003). Cultural tourism aims at the peculiarity and variety of attractions as a factor to diversify the tourist offer and direct it to the marginal areas. This trend offers new conceptual paradigms as opposed to mass tourism, often to environmental and socio-cultural due degradation (De Vecchis, 1979; Scarpelli, 2003; Montanari, 2003). Infrastructural marginality,

¹ ENIT acronym indicates the Italian Agency for Tourism. Originally named as Ente Nazionale Italiano per il Turismo, actually it is known as Agenzia Nazionale Italiana del Turismo. It has maintained its original acronym of ENIT.

² It is not possible to go into detail on aspects related to landscape planning. However, it is recommended to consult technical reports in support of Regional Landscape Plans which address the strategic planning of territory and the management of activities within it, compatibly with local environmental and historical-cultural structures.

socio-cultural valorisation and protection of environmental balances are three aspects to be combined for a new paradigm of sustainable tourism development. Moreover, in this direction, the strategic guidelines on tourism and local development in Italy are progressing.

According to the guidelines expressed by PST and Internal Areas Strategy, in the National Plan of Tourist Mobility, adopted by the Italian Ministry of Infrastructure and Transport (MIT), accessibility represents a fundamental factor to reduce the marginalization of internal endogenous areas and local resources (MIT, 2017). This plan proposes an innovative model of sustainable mobility, by the integration of traditional infrastructure networks (such as primary roads, railways, stations, road junctions and airports) with linear infrastructures relating to slow mobility such as historical and rural pathways and cycle paths. This innovative model aims to connect new touristic destinations to the main flows of human mobility.

Nevertheless, those national plans are generally based on qualitative subjective analysis rather than objective data-driven models. While subjective models are generally based on user driven evaluation and perception of territorial elements and processes, for datadriven models we mean analytical models that are based on the collection and analysis of quantitative data associated with physical features and the corresponding dynamics. The wider diffusion of subjective models, with respect to data-driven model, is generally motivated by the extreme difficulty in defining the quantitative criteria and parametrization of cultural and environmental assets.

This research investigates a data-driven framework and processing model for large scale quantitative analysis of touristic asset potential. The procedures are based on several data processing steps and in particular: input data preprocessing; gathering and data homogenization for importing the several diverse data sources into one unique processing environment; data format conversion (vector to raster) for developing the weighted sum of input geospatial layers. This modeling framework is applied to the Lazio Region, a landscape resource with a rich and diverse domain located in Central Italy.

The selection of Lazio as case study is

motivated by the peculiar characteristics of the regional landscape that include the majority of landscape features that may be found on the national scale (Pasquinelli D'Allegra, 2007). These peculiar structures are based on geomorphological and historical-settlement variety, the result of stratifications in the course of geological and human history that has formed different landscape features (Caputo, 2007)³. On substratum, geomorphological this environmental settlements and urban systems have been developed over time as demonstrated by areas of archaeological interest, the network of historical roads, rural villages as well as the diverse land, ecological and forest uses and functions (Pavesi, 2007). This case study is also suitable for testing the effectiveness of this data processing model for some critical aspects of the domain of interest. Those critical areas are mainly linked to the unbalance of the major urban systems (Rome in particular) and the related detriment of the physical and biological of the urban components landscape: cementification, urbanization and mass tourism have often impacted the environmental and ecological connections. jeopardizing the ecosystem balances and the conservation of widespread cultural heritage (De Vecchis, 1979).

Nonetheless. these resources are often located in marginal areas, relating to infrastructure networks and main hubs of mobility. This work employs open geo data from institutional web platforms of regional administrations, released to support local territorial planning and the government of the territory⁴. The results presented point out critical elements due to heterogeneity of the available open data. Nevertheless, they show the potential of GIS tools to implement quantitative analysis on a large scale to support territorial planning, decision and policy making.

³ Caputo identifies five varieties of landscape in the Lazio Region: volcanic, coastal, flat, karstic and glacial.

⁴ GIS data and tools increasingly support spatial and regional planning. In this regard, several Italian regional entities have created special platforms for the sharing and public release of digital information in the form of open data.

2. Multi-criteria approach using GIS tools: an overview

Geospatial layers depicting the several pieces of information related to territorial resources and functions can be analyzed by means of GIS mathematical and statistical methods - as weighted sum (WS) and fuzzy analysis (FA) with the aim of producing a summary dataset inheriting the combination of the input information. The weighted sum summarizes the different criteria useful for decisions in numerical values, according to the incidence they take in the final decision. Fuzzy analysis is value standardization technique on a а continuous scale from 0 to 1. Formally, it is an extension of Boolean logic (where a value is 1 or 0, true or false) to evaluate the suitability level of a property (Zadeh, 1975).

WS and FA, implemented in a GIS environment, are useful tools for developing territorial marketing, business and location intelligence strategies (Carver, 1991; Jiang and Eastman, 2000; Malczewski, 2006; Eldrandaly, 2013). WS and FA are useful methods to find location advantages in the distribution and management of public services (related to health, transport or education for example), productive, commercial and economic activities or to support urban and regional planning (Joerin et al., 2001; Gorsevski et al., 2011; Riad et al., 2011; Nyeko, 2012; Rikalovic et al., 2014; Mele and Poli, 2017).

Cultural activities and tourist promotion may take advantage of geo data and GIS tools that are usually employed to recognize and identify resources, attractions and services, spread around a specific geospatial context (Boyd and Butler, 1996; Boes and Cottrel, 2007). These elements define the structural territorial framework, in which tourist planning activities are implemented. Different studies propose innovative spatial analysis methods, based on a multi-criteria approach, in order to find the best location facilities to support and implement the fruition of cultural and natural heritage for planning and tourist purposes. In this way, different types of data are integrated to find the best potential of cultural and tourist development based on cultural heritage, natural and ecological resources, infrastructure networks and accessibility, public services, morphology,

climate and so on. In most cases it deals with experimental cases that consider all or part of the criteria mentioned before.

Some studies use GIS methods and tools to evaluate and classify natural and landscape resources relating to urban proximity (Bunruamkaew and Murayama, 2012: Rahavuningsih et al., 2015). Ahmadi et al. (2012) implemented a GIS method to recognize and rank suitable areas for ecotourism purposes in Ilam Province (Iran) relating to natural and archeological sites. climate, morphology, infrastructure and facilities proximity. Kumari et al. (2010) adopted a complex methodology to index and integrate different values such as vegetation, resiliency, ecology and biodiversity to find potential suitable areas for ecotourism development in the Sikkim District (India). Mele and Poli (2017) proposed a multi-criteria method with GIS tools to identify landscape and ecological services within the Metropolitan Area of Naples (Italy) to support planning and recreational activities. Carver et al. (2012) made recourse to new and innovative GIS models for mapping spatial patterns and the distribution of wildland in two Scottish national parks for recognition and management aims. GIS data and tools can also support recognition and assessment of cultural ecosystem services (CES) as a group of cultural elements and amenities that give nonmaterial benefits to citizenship (Sarukan and Whyte, 2005; De Groot et al., 2010). Studies related to CES focus on mapping ecological and cultural services to improve quality of life and public policies, especially in urban or peripheral areas, measuring the quantity and quality of available resources (Nahuelhual et al., 2013) and their proximity to the most populated areas (Caspersen and Olafsson, 2010; Koppen et al., 2014; Ala-Hulkko et al., 2016). Further studies identify and classify potential ecotourism sites, based on spatial centrality and network analysis to evaluate connections among villages and little towns (Lee et al., 2012; Yun, 2014).

These cases demonstrate that there are different ways to measure and assess natural, cultural and landscape resources for tourist and socio-economic development or planning purposes. It seems that different methodological approaches are related to specific goals, adopted criteria and to the availability and technical structuring of data. Recognition, identification and management of local resources for tourist and socio-economic development reflect specific normative and conceptual definitions that can differ on the basis of the geographic context or context-scale. Furthermore, tourist activities can have a strong impact on local social. environmental economic and structures. Therefore, it is noted that those forcing conditions shall be considered in order to develop optimal tailored analyses for tourism development.

Weighted sum and fuzzy analysis are employed to improve multi-criteria analysis, useful to study territorial phenomena with integrated data and homogeneous criteria (Greene et al., 2011; Jeong et al., 2012). Availability and homogeneous data structuring are two essential factors to apply and implement multi-criteria and fuzzy analysis. In this perspective, open geo data play a supporting role for strategic territorial planning and decision making. Divergent methods of data gathering and structuring obstruct comparative and largescale analysis. Data accuracy and precision are collocated at the basis of efficient analysis. To obtain accurate results, it is necessary to adopt and implement preliminary procedures of data homogenization, in order to set investigation methodologies on objective parameters.

3. Tourism and culture governance in Italian operational guidelines

Strategic planning policies define the governing operational guidelines cultural development and tourist promotion for territories. in particular while promoting emerging touristic destinations (Mangano, 2018). The practical implications of these policies rely on regional planning, socioeconomic and environmental frameworks (Magnaghi, 2016).

PST 2017-2022 and Internal Areas Strategy consider tourism as a key-sector on a local scale by stakeholders and local communities' involvement and integration within local development processes that concern internal areas. Internal areas are defined as those areas that are "*meaningfully distant from the centers of essential services offer, rich of important* environmental and cultural resource, strongly diversified for nature and after secular anthropization processes" (Agenzia per la Coesione Territoriale, 2014). Among the PST's strategic goals are the innovation and diversification of the tourist offer, through the recovery of landscape and identity values and their integration and connection through intermodal infrastructure networks, useful for accessibility and the fruition of local heritage and services. PST's strategic goals are focused on the valorization of natural and cultural heritage, social cohesion and accessibility through innovative and sustainable mobility networks (MiBACT, 2017).

The Italian Cultural Heritage and Landscape Code defines and protects those territory portions with high environmental, historical, cultural and aesthetic values, through specific zoning in which land use is protected by specific regulations in coordination with urban and local level planning (Civitarese Matteucci, 2005; Sciullo, 2008; Marzuoli, 2008). Its main innovations concern the extension of landscape planning to the whole territory, including marginal and degraded areas (Gambino, 2007; Gisotti, 2016) and the definition of territorial transformation rules in which landscape and cultural heritage inherit a design value (Paolinelli, 2011; Poli, 2012; Magnaghi, 2016). For the selected case study, the Regional Territorial and Landscape Plan of Lazio Region (PTPR) establishes territorial frameworks. defined by preliminary recognition and exploratory activities, in order to identify environmental, archeological and historical features of landscape (Regione Lazio, 2007). The PTPR regional planning zones characterize regulated areas associated with constraining definitions that are based on socio-economic frameworks, because they define activities and structural operations that concern territory and land use allowed, also for tourist and recreational purpose (Regione Lazio, 2007).

The PTPR aims to identify and enhance peculiar local frameworks, as a result of consolidated interrelations between nature, cultural dimension, history, land use and local communities.

4. Experimental GIS methodology for mapping the touristic potential

A GIS methodology is here developed to map and index touristic development potential, based on two of the main criteria considered by previously reported strategic policies:

- 1) Landscape patterns;
- 2) Accessibility and proximity.

The first criterion refers to zoning and protected areas defined by PTPR Lazio, adopted in 2007. Zoning and protected areas regard every type of resource that characterizes local landscape structures including also buffer areas related to single archeological or architectural sites, historical road networks, buffer areas that delimitate hamlets, towns or villages and protected areas too. The second criterion refers to drive-time areas, calculated on the time route from a common origin point, represented by Roma Termini, the main railway station of the city and one of the main hubs on a regional and national scale. This methodological hypothesis has only an approximate purpose and aims to demonstrate the technical and procedural aspects. It could be applied and implemented by considering other source points (for example: other railway stations, road junctions or specific points of interest). The methodology is divided into the following phases (Figure 1):

a) Data gathering

This analysis employs open geo data, available on the Lazio Region administration's official web portal, referring to landscape zoning and protected areas defined by PTPR 2007. Other data sources are Open Linked Data of the Ministry of Cultural Heritage and Tourism and ISTAT. A verification procedure has also been used with regard to structural and technical data specification (geometry and projection). This procedure is preliminary to the next phase. Only polygonal vector features are chosen for the purpose of this work. Every single data set is projected in UTM WGS84 32 N, to allow the next elaboration and information layer homogenization.

b) Data homogenization into layer

Data homogenization is here performed by an editing procedure applied to attribute table information of geospatial input layers. The goal is to obtain the same information and the same attribute table structure to implement merge functions to aggregate data⁵. This passage does not impact or modify the input layer geometry.

This step is followed by the next step that consists in merging data in order to produce a final homogeneous layer. Layers are descriptive of essential elements that compose landscape and protected areas (Figure 2). This merging procedure produces eight layers, as illustrated in Table 1.



Figure 1. Flow chart of experimental GIS methodology.

⁵ Attribute information refers to these common fields: *"file_name"*: refers to the original name of the feature; *"Name"*: refers to place name; *"leg_dom"*: refers to territorial dominion; *"law"*: specific law that determines zoning or protected area; *"content"*: refers to the descriptive category of feature; *"leg_cod"*: numerical code that identifies the descriptive category.

Code	Layer typology	Description
1	Coastal territories	300 m shoreline
2	Protected areas	Parks and natural reserves, wilderness areas
3	Mountains	Mountain territories over 1200 m
4	Forests & woods	Forest land coverage
5	Archeological areas	Areas, sites and viability of archeological interest
6	Public interest areas	landscape features Human footprints and
7	Hydrology	buffer areas Lake and rivers
8	UNESCO WHL sites	WHL-UNESCO Sites and cultural landscape in

Table 1. List of homogeneous landscape protected area layers.

Drive-time areas were obtained by the ArcGIS Online tool *Perform Analysis, Use Proximity.* The layers illustrated in Figure 3 represent the time-coverage from Roma Termini, divided into four ranges of time:

- 0-30 minutes;
- 31-60 minutes;
- 61-90 minutes;
- 91-120 minutes.



Figure 2. Landscape homogeneous layers. Source: elaboration on Open Data Lazio.



Figure 3. Drive-time areas from Roma Termini. Source: elaboration on data ISTAT.

c) Raster value transformation

Vector layers were converted into raster format. This passage has made it possible to implement a sum calculation, to obtain useful values for the final index. The cell raster resolution chosen is 100 meters. This detailed resolution has made it possible to involve every single element in the next elaborations that characterize landscape and heritage value, pointing out aggregation and value hot spots.

d) Weighted sum and fuzzy analysis

The execution of the weighed sum and the fuzzy analysis required a preliminary assignment of weights and values that impact the outcome of the final index estimation. This step integrates the different inputs (cultural and environmental assets on the one hand, accessibility times on the other) into a single output layer representing the distribution of the final values. Since these criteria are difficult to be objectively quantified on the basis of reference parameters, the assignment of values and weights reflects the compendium of a survey within the working group in order to:

1. Show the methodological effectiveness of multi-criteria analysis in the site suitability selection;

2. Present a flexible and adaptive model of analysis on multiple criteria on different contexts and scale levels.

Homogeneous layers are divided into two general groups:

- Protected landscape areas: combination of layer afferent to natural and cultural heritage that determine zoning and protected areas.
- Accessibility: combination of drive-time areas.

It has assigned a specific weight for each group. It determines the incidence of protected areas (weight = 1) and accessibility (weight =

0.5) in the final elaboration data index. A maximum value of 1 is assigned to attraction elements. Accessibility, in this case, is considered as an element of support to tourist activities.

A specific value for each layer is then applied, to establish the incidence that every landscape and drive-time layer has in the final weighted sum, as shown in Table 2.

Protected landscape areas layers	Value	Weight
Coastal territories	1	1
Protected areas	2	1
Mountains	1	1
Forest & woods	1	1
Archeological areas	2	1
Public interest areas	2	1
Hydrology	1	1
UNESCO WHL sites	3	1
Drive Time areas	Value	Weight
Drive time 0-30 minutes	1	0.5
Drive time 30-60 minutes	0.75	0.5
Drive time 60-90 minutes	0.50	0.5
Drive time 90- 120 minutes	0.25	0.5

Table 2. Values and weights for each layer.

A scale of values from 1 to 3 has been applied to the Protected Landscape areas on the

basis of the following criteria: the environmental value was assigned the starting value 1 as that constitute components the physical substratum of the landscape; to cultural heritage an additional value of 2 as areas transformed by the anthropic footprint that over time has defined the evolutionary settlements of the territory; finally to the UNESCO sites the maximum value of 3 for their international relevance as registered in the World Heritage List. The definition of travel times has been set by assigning the maximum value of 1 to areas near the pre-defined point of origin (Roma Termini train station); the other values were assigned by subtracting the fixed decimal value equal to 0.25.

5. Results

Figure 4 illustrates the output layer generated by the proposed analysis that was implemented in the GIS environment.

The weighted sum and fuzzy analyses depict and quantitatively identify areas most suitable for tourist development. The index presented is able to map hotspots associated to high-value of potential attractiveness and aggregation for incoming tourists. Hotspots identify geographic areas where the forcing conditions of touristic value and accessibility are both valuable.

Value and weight assignment were carried out by *Weighted Sum*, within the ESRI ArcGIS *Spatial Analyst* tools. This step returned the row value for every single 100 meter resolution cell. The row values were then elaborated into *Fuzzy Membership* tools, in order to reclassify the value within the numeric range between 0 and 1. This made it possible to have an easy comprehensible interpretation of the cartographic product.

The hotspots reflect the concentration of high values (i.e. tending to the maximum value equal to 1) given by the overlap of the original vectorial information layers. This means that the value of each individual cell (equal to 100 meters) is determined by the number of landscape elements that exist on it, integrated with the accessibility times. The picture that emerges appears to be varied and diversified, with several areas of high value hotspots spread around the region. By comparing the distribution of the output values (Figure 4) with the distribution and the geographic extension of the landscape elements considered (represented by vector layers - Figure 2), it is possible to see how the higher values are located where the intersection of the elements involves different layers of information.

In a perspective of tourism valorization of the territory, the hotspot areas can lead to a diversification of the offer and encourage innovative forms of the use of environmental and cultural assets.

The results obtained should however be interpreted from an experimental point of view.

A different assignment of values and weights – as well as the adoption of different inputs that integrate the choices made here – can lead to a different cartographic indexation. The subjective assignment of the values and weights performed in the methodology (see paragraph 4d) was carried out for the sole purpose of completing the technical procedure of the work. However, it leaves open the possibility for decision-makers and territorial stakeholders to set their own criteria of analysis based on the needs and objectives established in the planning and decision-making phase.



Figure 4. Index map of potential tourist development areas. Source: elaboration on Open Data Lazio and data ISTAT.

6. Conclusions

The final mapping results provide an overview of the Lazio region's touristic potential, pointing out the complexity of the landscape structure. This complexity also represents the potential value of the diversification of the tourist market, that will be tailored to landscape features and territorial frameworks. The test case presented also confirms the efficiency of GIS data and tools to define and implement supporting strategies for decision and policy making, involving territorial and socio-economic frameworks. The original intent of this research work was to offer a first food for thought in response to the outstanding issues posed by the marginality of the internal areas and the need to innovate the strategy of territorial development around environmental and cultural assets, underlining the potential of digital tools and open geo data available in the context of the continuous and constant digitalization of the economy and public services.

This research presented a new innovative GIS method to find suitable areas for tourist and recreational purpose based on criteria established in the strategic operational guidelines adopted in the Italian national and regional context.

However, we posit that, while achieving the goal of conceptualizing a GIS framework for the objective analysis of touristic territorial performances, our work is far from providing a generalizable and transferable tool. This leads to define several potential further work aspects of this research related to the discussion on the tourist development of the territory in terms of sustainable development and social involvement. Further data types might to be integrated within any future implementation of this GIS methodology in order to:

- Enlarge spatial analysis scale to different geographic areas or regions;
- Consider other essential and strategic criteria related to slow mobility and green infrastructure.

These latter conditions make it possible to find innovative solutions to promote the use of intermodal transport networks, in a sustainable development, raise awareness regarding the use of available resources and enhance a socioeconomic and cultural framework perspective.

In this sense, data on land use, agriculture, settlement and economic structures, sociodemographic frameworks, landslide and flood risks can provide complementary information to zoning and landscape features and accessibility time data.

Further innovative contributions can be provided by the use of bottom-up information, in a perspective of the active involvement of citizens and visitors in decision-making processes and planning of the territory, through the use of digital consumer devices (such as smartphones). Information shared, collected, georeferenced and verified by experts can offer new and interesting insights for the geographic knowledge at the basis of the territorial planning and valorization of its resources. Digital tools for the production of geographic data by individual users already exist: consider, for example, Survey 123 for ArcGIS (https://survey123.arcgis.com/), applications for hiking and ecotourism such as Wikiloc (https://it.wikiloc.com/) or iNaturalist (https://www.inaturalist.org/). An increased use of these tools by institutions can be employed to promote processes of social and territorial cohesion with a prospect to a greater sharing of geo-referenced data of collective interest. Nevertheless, open data availability is an essential requirement to make improvements to this GIS methodology. Geographic knowledge and spatial innovative solutions go through the availability and structuration of data information. This is the main challenge posed by digital transformation and digital geography tools.

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The impact of digital geo-iconography. Limits and potentialities of the use of online sources for the history of cartography

Marco Petrella^a

^a Dipartimento di Bioscienze e Territorio, University of Molise, Termoli (CB), Italy Email: marco.petrella@unimol.it

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Abstract

This paper is a step of a research project aiming at analyzing in an empirical, user-oriented perspective the perception of how online geographical tools impact on geographical research. In details, the article focuses on recently developed web tools in the field of history of cartography and outlines the implications, in terms of limits and potentialities, of digital cartography at an academical level. In such analysis, the paper also dwells on participatory tools and digital earth models as tools for history of cartography. For this purpose, the paper analyses the results of a survey conducted by asking academic scholars in history of cartography their perception of the limits and potentialities of recently developed tools. What emerges from the research is a widespread perception of a series of potentialities and at the same time a consciousness of many critical issues, especially for what concerns participative tools and GeoWeb resources. Digital tools have profoundly modified academic research, becoming in some aspects tools for its enhancement. Nevertheless, their undisputed merit is that they have drawn the attention of a wider public, albeit through messages that are sometimes misleading, to the map as a means of communication.

Keywords: Academic Research, Digital Resources, GeoWeb, Historical Maps, User Perception, Volunteered Mapping

1. Introduction

The developments and changes that have been registered since the 90s of the last century in the availability of digital data sources is unprecedented. In general, such a diffusion, concerning also the field of geo-historical-data, occurred simultaneously as the spread of Semantic Web technologies (Berners-Lee et al., 2001; Meroño-Peñuela et al., 2014). Online cartographic resources for the study of the image of the territory are currently significant (and in some cases essential) tools used by researchers in several geography research foci, i.e. cartography, history of territory, landscape and urban studies, etc. At present, digital sources are perceived as fundamental instruments for solving geographical and historiographical problems concerning, among others, map epistemology, map functions and mapmaking techniques, the evolution of the territory, the evolution of organization and function of urban space, place names. Traditionally conducted de visu by directly searching and analyzing maps in libraries and archives, academic research has been progressively substituted by new web tools. The availability of digitized historic cartographies accessible on web portals - national, academic and civil libraries, etc. - has drastically changed a consolidated way of approaching maps, traditionnally based on material links, to new ways of organizing, finding, and analyzing documents (Azzari, 2010).

Within the enormous, partially analyzed theme of the impact that recent web innovations have on scientific production in historical geography and history of cartography (Gregory and Healey, 2007; Ash, Kitchin and Leszczynski, 2018 among others), we have chosen to dwell on the tools providing free access online digital sources for history of cartography academic research. In fact, the last decades experienced both an exponentially growing effort to make high resolution digital cartographies available on web portals and innovative ways to organize the geographic digital knowledge have been registered in many countries and contexts. The evolution has represented an important challenge and opportunity for scholars and libraries, but it involved a series of changes (Boria, 2013; Goldberg et al., 2014). Such effort of mass digitization provides innovative ways for scholars to approach an enormous number of sources for studying maps, especially when these materials are fully distributed into the public domain. This process is bringing new developments in spatial analysis with their use in historical GIS projects (Gregory and Geddes, 2014). Furthermore, recent developments in mass digitization of old maps seem to have expanded the possibility of carrying out researches and finding unexpected relations among documents and inside the document. Finally, such evolution probably has a significant intellectual value in the sense of an idea generator for human geographers, "providing inspiration for what is map-able and

ways to represent space more creatively" (Dodge, 2017, p. 11).

Mass digitization has been accompanied by spread geographic the of volunteered information (VGI) (Goodchild, 2007) and GeoWeb (Elwood, 2010). In recent years, in fact, many kinds of sources for geo-historical information have been offered in the form of user-generated content in the contest of the Web 2.0. In details, crowdsourced strategies have often been used for improving both information about available data - i.e. metadata - and getting available new geo-iconographical documents. The trend towards a "neogeography" - i.e. the attitude of non-specialized people creating maps and information about maps (Turner, 2006) notwithstanding an uncertainty regarding the quality and accuracy of the VGI data, especially in remote contests and less studied topics (Giles. 2005) - is nowadays a consolidated phenomenon, especially for geo-referencing (Borruso, 2010; Fleet, Kowal and Pridal, 2012).

At this point, the passage from a traditional search based on a logical taxonomy proposing a traditional index is progressively giving way to a relatively new model to find sources (Favretto, 2016). As far as organization of knowledge is concerned, it can be defined according to Kant, as an alternative to logical classification as those of Linnaeus, based on space and time. The former, linked to geography, classifying things according to the principle of closeness and proximity, showing us things that are placed the one next to the other, as they really are in nature, the latter being the telling of human actions determined by the laws of nature and orienting our intellect according to a substantial interpretation of the world leading to an objective reality (Kant, 1968; Farinelli, 2003). The impact of such a new organization of geo-historic online information based on a chrono-spatial interface on the research in history of cartography is still a scarcely attended field of study.

This essay follows a first study published in 2004 (Petrella and Santini, 2004) focused on the diffusion of internet resources in a geo-historical context. Focusing on the wide range of new possibilities and unexpected applications of innovative technologies concerning the study of the representation of the city, the former essay proposed some criteria for a critical evaluation of the resources available on the net by analyzing a sample of web projects containing a wide range of maps. Most of these activities were pioneer enterprises promoted by both public and private universities, libraries, research bodies and other subjects whose main aim was to make reproductions of digitalized iconographic documents, particularly maps, accessible online. The first work has been re-elaborated a few years ago, inspired by a changed scenario of the potentialities of online resources in recent years: it seemed important a goal to reflect on the deep transformations that have been taking place in the last ten years (Petrella, 2014).

The present research aims both to analyze the perception of potentialities and limits by scholars of free online iconographic resources and to explain how scholars, at present use and conceive online resources for the history of cartography.

2. Tradition and innovation. Searching, connecting and analyzing iconographic sources in the participatory web

The transition from a traditional way of using the Internet – characterized by a substantial reproduction of traditional models and publishing techniques to new practices of creation and fruition of content in education, library and research domains – has been the object of many studies (Andrersen, 2007; Goodchild 2007; O'Reilly, 2009 among others)¹.

Referring in detail to Web 2.0 technologies, Dan Cohen and Roy Rosenzweig provided a useful summary of what are commonly considered the positive and negative aspects of the Internet applied to geo-historical studies (Cohen and Rosenzweig, 2006). According to the authors, new perspectives in online sources are able to create connections among different people regardless of where they are located: thanks to user generated content, post Web 1.0 strategies in particular facilitate collaboration and interactivity among people and enable the development of augmented knowledge and learning; nevertheless many disadvantages and problems are obviously due to a certain insecurity and instability of the information and the limited time span of the contents, which become quickly unobtainable. Another critical issue lies in the quality of the resources. This problem is perceived as particularly important because of the intrinsic lack of editorial promoted by the recent authoritativeness developments on the web: its "democratic" and participative logic is antithetic to the principles of the academic research (Holman Rector, 2008).

Also in traditional contexts, the application of user-generated contents may activate processes that proves to be unable to guarantee the credibility of the source (Metitieri, 2009). Nevertheless, it is especially on the web that the crowdsourcing validating the most popular content would be totally illusory because a large majority of people are not able to track down the best contents, but only the most popular, that are selected by the number of inbound links (Lanier, 2010; Lovink, 2012; Turkle, 2011). Darnton also points out how the communication circle running from the author to the reader can be hardly transferred to Internet resources. It is particularly in the lack of warranty offered by an explicit point of view, the author, that we can find the greatest obstacle to an academic use of most of user generated sources (Darnton, 2009). What evidently appears in the literature on the subject is a systematic fluctuation between an enthusiastic approach to current trends, inter-

¹ In this context, according to the current computer sciences literature, Web 1.0 age, we mean the traditional model of communication based on a one-way information structure (from the content generator to the user) while Web 2.0, that appeared between 2000 and 2009 is considered the first attempt to create user-generated contents: blogs, forums, first forms of social networks, etc. With Web 3.0, characterising the present age, we refer to the moment of a massive presence of active users into media. Web 3.0 tries to organize the way content is searched and viewed. by the user. The goal is to customize and optimize the online search by achieving the Semantic Web. Finally, Web 4.0 features a strong interaction between humans and machines. It is characterised mainly by the presence of massive data sets, augmented reality and infinite creative space (Chondhury, 2014; Noh 2015; Tripathi and Khumar, 2010). We use this ter-

minology with the consciousness that as explained by Barassy and Treré (2012) at a level of lived experience of technologies, such a linear, theoretical periodization may prove to be overly simplistic.

preted as a progress factor, an attempt to solve the problems and limits affecting the traditional publishing, and a critical approach stigmatizing the new tendencies as dangerous in cultural and social terms (Noiret, 2011a).

The same, dualistic scheme may be applied when considering the operating criteria of a search engine like Google. Notwithstanding the enormous progress in its application, Tim Berners-Lee's idea of Semantic Web, a web context that is supposed to offer the concrete possibility of most advanced and refined researches (Berners-Lee, Hendler and Lassila, 2001; Shadbolt, Hall and Berners-Lee, 2006 among others) still seems to be utopian in its accomplishment at present. The sense of frustration when looking at the abundance of answers for queries in the field of geo-iconographic sources still causes an attitude of resignation and passive acceptance of the results placed at the highest hierarchical level, mostly far from being the most pertinent ones (Brophy and Bawden, 2005). The idea that the results presented as the most important are objectively the most pertinent for our research, for example, can be a real risk for those people less devoted to online historiographic search (Minuti, 2008), especially in didactic activity. And though some studies have showed that open participatory sources like Wikipedia could indicate a certain accuracy, especially in the case of most known and long articles (Blumenstock, 2008) the problem of the difficult search through an automated tool in the horde of online information still exists. The aforesaid problem is only partially solved by the continuous development of searching algorithms employed by Google and other search engines. These tools, in fact, pose some critical issues related to the way search engine selections and hierarchization of data is conducted (Brin and Page, 2012; Campbell Halavais, 2018).

As a consequence of the further confusion generated by the evolution of the web and the tendency to crowdsourcing, it is generally perceived that a partial solution lies in the education to the proper use of the network for academic purposes. As pointed out by Serge Noiret, competence in the use of digital sources, at least in Europe, should result in a widespread Information and Communication Technology (ICT) training system (Noiret, 2008).

3. Digital geo-iconography tools: analytical examples of a mostly nonacademic context

The great transformations occurred during the transition from the era of Web 2.0 to that of Web 3.0 have been accompanied by a growing number of researchers using specialized, thematic Internet tools to find and analyze geohistorical sources (Crampton, 2009). That was the result of a strong diffusion of a variety of virtual tools ranging from meta-catalogs to GeoWeb and geo-collaboration tools compared to the situation in the past, a remarkable evolution in fact can be found in the number of sites whose resources are indexed in metasearch engines (Lynch, 1997), allowing the simultaneous query of several catalogs. Also in the geo-iconographical field, the most used are probably the KVK (Karlsruhe Virtual Catalogue [KVK] hosted by the Institute of Technology in Karlsruhe) and WorldCat – the global catalog of the Online Computer Library Center (OCLC).

In this context the specific field of history of cartography experienced a great development of old consolidated projects aiming at clustering for a wide coverage search of the maps, whose complex articulation is well outlined by Joel Kovarsky (Kovarsky, 2012). One of the oldest is certainly the IKAR Database of Old maps [http://ikar.staatsbibliothek-berlin.de/allgemeines /english.html], a collaborative project of several German libraries launched in 1985, containing over 250000 cartographic records; around 4500 digitalized maps are available for consultation.

One more important project is "The European Library" [http://www.theeuropeanlibrary.org/], an independent not-for-profit library services organization whose mission is to strengthen libraries across the continent and to be a benchmark for library data in Europe. However, the most representative for the exploitation of the potentiality of the Internet is probably Old maps online [http://www.oldmapsonline.org/], a transnational project indexing over 400000 online maps coming from 35 different institutions.

Another relevant phenomenon emerging in recent years is the increasing role played by open digital libraries collecting materials coming from a growing number of digital tools. They ensure a connection among various virtual libraries, enabling researchers - as metasearch engines do - to find the required sources. In this field, the example of Europeana, an open digital collection containing materials from all over [http://www.europeana.eu/portal/], Europe is representative of the new tendencies linked to Web 2.0. In fact, Europeana is characterized by an open storage and fruition process concerning artistic works and heritage objects from 27 countries. On this website, users can find images, maps and manuscripts that can be visualized in different ways (following a chronological order, a place index, a map) and organized in an hypertextual structure that allows users different surfing options.

The multitude of online projects providing free online sources for humanistic research at present covers a vast subject area and offers an ever increase quantity of contents. The continuous growth of thematic repertories such as Tony Campbell's Map History (www.maphistory.info), that can be considered a milestone for the scholars in history of cartography, witnesses the ongoing transformation taking place in the cartographic historical resources context². Such evolution of Internet databases and digital libraries in recent years has generally amplified and transformed the possibilities to conduct academic and nonacademic research. The availability of a massive number of digitized documents in fact has increased the potential audience for the study of library collections: such tendency has made possible the creation of online structured catalogs that endeavored to combine the needs of researchers with those of a wider audience. Especially projects with a long tradition (at this level it is noteworthy that our analysis shows that more than 80% of the virtual libraries surveyed in our study carried out in 2004 are still active, despite the alleged fragility of the virtual content) are characterized both by an intensive activity of digitalization and a constant review of the paratextual information related to documents (i.e. technical and scientific metadata).

What occurred to the well-known French digital Library Gallica (http://gallica.bnf.fr/) is symbolic for that purpose. This project, in fact, contributed to the digitalization of an enormous corpus of cartographic material preserved in the *Département de Cartes et Plans* of the French National Library. Furthermore, it has given the opportunity to launch a correction procedure of numerous author attributions and catalog data, most of them dating back to the first half of the last century. It is consequently remarkable that digitalization projects can be conceived also as a global intervention restructuring the entire process of map conservation, preservation and study.

The experience of the David Rumsey Historical Map Collection [www.davidrumsey.com], recently donated to the Stanford University Library, containing more than 150000 maps from 16th to 21st century is representative at that level. Allowing users to consult maps using a variety of advanced and intuitive tools, ranging from Google Earth to Second Life and the Luna Imaging viewer, (Jones, 2017), the David Rumsey Map Collection witnesses a certain tendency to elaborate advanced systems for the management of big data and at the same time visualization tools even for non-professional users (Figure 1).

At this level the development of advanced projects born with the aim of both preserving and promoting the fruition of their map collections and the knowledge of cartographic cultures for primary and secondary school students is noteworthy. It is the case, for instance, of the initiatives lead by the Leventhal Map Center and the Smith Center for Cartographic Education, the former established at the Boston Public Library the latter at the Osher Map Library of the University of Southern Maine (https://usm.maine.edu/osher-map-library). Both the centers were conceived to promote academic and educational use of their cartographic heritage, collecting and preserving maps and atlases (Theunissen, 2007; Thonberry, 2017).

A further category of resources witnessing the development of free access quality images and inventory for the study of history of cartography is represented by some active projects carried out by map dealers. It is the case

² Created in 2001 as a section of the WWW Virtual Library (VL) project and regularly updated since then, Map History index is a thematic, analytical repertory organized both by regions, themes and typology of resources, counting more than two thousand and five hundred links to cartographic resources described in their key features.

of the site www.raremaps.com owned by Barry Lawrence Ruderman Antique Maps collectors who started and crafted their collections, a commercial experience playing an important role in the diffusion of free high quality digital copies of antique maps (Figure 2).

The use of participatory web tools for georeferencing documents is progressively developing in virtual archives and libraries thus some well-known projects such as the David Rumsey collection seem to confirm that tendency also in the history of cartography field. The availability of easy-to-use applications such as Georeferencer for example, has allowed the David Rumsey project to have around 20% of its cartographic database georeferenced. This tool also provides a virtual *mappamundi* enabling the user to search the document on a cartographic interface. An analog example is the experience of the *Cartoteca Digital* of the *Institut Cartogràfic i Geològic de Catalunya* (Figure 3).

The aforementioned experiences outline how the issue of spatial data quality is an encouraging challenge in the field of volunteered geographical information. Nevertheless, the lack of quality assurance procedures and the lack of central coordination might represent a strong limit of these growing processes where, because of the lack of a significant number of volunteers involved, the so called "Linus Law" cannot be applied (Haklay, Basiouka, Antoniou and Ather, 2013).

The interest in cartographic documents by a wide public allowed the development of complex projects, whose advancements had an immediate impact on the research in history of cartography. Such an impact can be traced first of all, in the increase in the quality and quantity of available resources (with strong repercussions on the quality and quantity of research in the history of cartography) and, secondly, in the development of software and interfaces for viewing and analysing maps. The perception of the limits and evolution of such a digital world by history of cartography scholars is a focus of the following part of the article where the results of the empiric survey are shown.

4. The empiric research: methodology

One of the key elements that inspired this research was the attempt to understand how online resources containing free access maps are perceived by academic researchers; in particular, the research aimed to understand how the search of online sources is carried out in the digital world, the perception of the potential of online tools and, finally, the way those tools changed the way scholars conduct research. Consequently, a semi-structured questionnaire was submitted to a sample of history of cartography scholars.

The aim of the survey was to obtain a realistic picture of the world of contemporary history of cartography scholars. For this reason, the questionnaire was sent to all the 89 authors who wrote an article on the scientific journal *Imago Mundi* in the last eight years³.

³ In details, the questionnaire was sent by email using the Google Form tool. It was sent to the following scholars: M.O. Ahrens, James R. Akerman, Isabella Alexander, Mirela Altic, Joaquim Alves Gaspar, John H. Andrews, Pnina Arad, Peter Barber, C. Cody Barteet, Robert Batchelor, Luca Berardi, Stéphane J. L. Blond, David I. Bower, Catherine E. Burdick, Mario Cams. Genevieve Carlton. Mariarosa Cesari. Ian Chambers, Pilar Chías Navarro, Edward Collins, Delia Cosentino, Antonio Crespo Sanz, Marie Cronier, John E. Crowley, Gyuri Danku, Stephen Davies, Catherine Delano Smith, Veronica della Dora, Joost Depuydt, Catherine T. Dunlop, Thomas de Wesselow, Martin Dodge, Matthew H. Edney, Patrick Ellis, Anders Engberg-Pedersen, Josipo Faricic, Junia Ferreira Furtado, Gabriel Granado-Castro, Federico Ferretti, Dori Griffin, John Walter Hawkins, Michael Heffernan, Rachel Hewitt, Hirotada Kawamura ,Dirk Imhof Kimberly C. Kowal, James Krokar, Morgane Labbé, Martin Lehmann, Laura Lehua Yim, Henrique Leitão, Denis Longchamps, Pedro Luengo, Annaleigh Margey, Julie McDougall Waters, Michael Martin, Sergio Mejía, Lena Mirosevic, Carme Montaner, Frederik Muller, Lory L. Murray, Alastair W. Pearson, Jonathan Pepler, Sandra Pinto, Antonio Sànchez, Ian James Saunders, Dmitry A. Schlengov, Zef Segal, Vera Segre, William D. Shannon, T. M. Smallwood, Richard H. P. Smith, Elizabeth Solopova, Stig Svenningsen, Dan Terkla, Luis Urteaga, Rafael Valdares, Marcel van den Broecke, Chet Van Duzer, Soetkin Vervust. María Isabel Vicente Maroto, Armin Wolf.



Figure 1. A Luna Browser visualization of the "Italia Divisa ne suoi Regni Principati, Ducati et altri Dominii si come al presente si Ritrova" by Giovanni Giacomo de Rossi. Source: David Rumsey Map Collection.



Figure 2. A detail of the satirical map "Carriers of the New Black Plague", Baltimore, 1938. Source: www.raremaps.com.



Figure 3. A georeferenced "Plan du port de Barcelone" by Jaques Ayrouard. Source: Cartoteca Digital of the Institut Cartogràfic i Geològic de Catalunya.

Imago Mundi was chosen as the only journal with a ranked impact factor dedicated exclusively to the history of cartography. The choice of Imago mundi has made it possible to select, among the various profiles of scholars who use maps for their research and didactics activity, those whose object of study focuses specifically on the map as a medium. The choice of this sampling methodology has allowed the identification small of but highly а representative sample of experts, that resulted to be varied in terms of age, nationality, scientific field of study and academic background⁴. This approach obtained the answers of 22 scholars.

In this first stage of empirical research, the number of interviews collected was considered congruous in order to proceed, parallel with an early, partial, quantitative analysis of the results, with the identification of a series of critical issues and with a first evaluation of the potentials of online resources. For this purpose, respondents were asked essay questions.

The questionnaire was divided into four parts: the first one, the personal data section, was notably used for а preliminary understanding and analysis of the characteristics of the sample (heterogeneity, representativeness, etc.); the second part, "Current use of online tools providing online sources" had a significant role in understanding the overall impact of online tools and sources in research activity; the third section, "Searching digital documents" was conceived with the aim of making an analysis of the most used tools to search for documents and of the perception of efficiency, limits and added values of these tools; finally, the fourth section, "Digital contexts and documents", the most extensive section and core of the research, was structured with essay questions. It attempted at evaluating the perception of current limits and potentialities of online tools with free access iconographic sources, Digital Earth and participative tools. Quantitative data, in fact, were used to describe the overall trend of transformations taking place in the use of online sources.

5. Results

As expected, the "Current use of online tools" section has shown an overall trend towards the constant use of online tools for research: more than 40% of the sample declares that they always use online sources in their research activities; another 40%, instead, uses them very often. Very few interviewees, however, admit using them only sometimes. Confirming the importance of free online sources in research, 41% of respondents say online sources play a key role in the research profession, while more than 45% of respondents say they are very important.

The second part of the survey, on the other hand, deals with the problem of finding sources. Despite a clear majority of respondents who not surprisingly admit using always Google as a tool for the initial search of geo-iconographic sources, what is significant is the relevant role of digital collections and libraries search tools that are commonly used as a starting point for sources' research by 43% of the respondents. It is probably the sign of a perception of a trust in these resources by scholars. The finding of the queried source by using a search engine, in fact, is not always fully satisfying: in a scale ranging from 1 to 5, most of the interviewees (38%) choose 3. That is probably why the most reported feelings when searching online sources on a search engine are not optimistic: 36% of interviewees admit doubting about the efficiency of Internet tools for their research and 18% declare finding difficulties because the searched object is often hard to find in the sorted list. On the other hand, a positive perception is witnessed by 18% of interviewees who are satisfied with their online search engine researches (Figure 4). Moreover, the last question of the section, "How important are online search tools for discovering iconographic sources in your research experience?" reveals an important function of online search tools: its fundamental role in discovering documents whose existence was ignored.

⁴ In fact, despite a certain prevalence of responses from the 35-44 age group, there is an almost equal response among the other ages groups (25-34, 45-54, 55-64, 65+). The interviewees are 62% male and 38% female and come from 12 different countries: from the United States to Russia, from Chile to Australia. Their study interests, as well as academic background, vary widely; however, there is a certain prevalence of geographers and a strong prevalence of researchers from academic contexts.

The first question of the fourth section, "What kind of online resources do you use more frequently?", witnesses a significant trust in digital map collections (86% of the answers) and in digital libraries (73%); on the contrary, the same question shows a fruitful but less developed exploitation of meta-digital library (32%). Finally, none of the interviewees declares to rely on virtual globe tools frequently. That could be interpreted as a clue of a relatively important perception of the use of such instruments for history of cartography research (Figure 5).

Dealing with the pervasiveness of online digital resources in research, what is notable is that only one of the interviewees think that the possibility to carry out a research in their field of studies without consulting traditional archives or libraries is possible; for 63% of the respondents, in fact, consulting material archives is still fundamental. That seems to happen mainly as a result of the quantity of materials scanned in digital libraries and archives: about the quantity of sources available on digital tools, in fact, 48% of the respondents, in a scale ranging from 1 to 5, choose 3 as indicator of the level of satisfaction. On the contrary, other questions led to the understanding that respondents don't seem to experience problems with the quality of online sources. 50% of the sample, in fact, This prefers digital sources. happens notwithstanding the intrinsic limits of digital analysis (i.e. lack of tactility, no possibility to see the document from a point of view, no possibility to do sensorial analysis of the materials, etc). Nevertheless, a certain number of scholars (32%) are still linked to the traditional fruition into the archives, still preferring material sources (Figure 6).



C3. What are the most important feelings when searching online geoiconographic sources by a search engine?

Figure 4. The perception of the utility of search engines when looking for iconographic sources.



D1. What kind of online resources do you use more frequently?

Figure 5. The most used kinds of resources.

22 responses



Figure 6. The fruition of digital sources in comparison to material ones.

The limits that the respondents detect in online digital sources are mostly due to the availability of documents: it has been often noticed, for instance, that the amount of available digital documents is still greatly reduced compared to the quantity of material ones. Other limits are linked to the quality of the tools: paywalls, copyright restrictions, low resolution, lack of information regarding such aspects as minute detail, accurate colour, lack of information about the reverse side of the document, and lack of sufficiently high quality metadata/cataloguing to allow a fruitful analysis and a contextualization of the document (the version of the image, whether it is contained in a book or not, the attribution of the authors in case of maps without names on it, etc). Finally, other restrictions are attributable to the intrinsic limits of digital maps: digital documents do not allow a full analysis of the physical features of the maps (quality of paper, paper treatment, watermarks, information about their use). Moreover, there are some basic risks connected to carrying out a research using digital: their availability might be dangerous in the sense that it could entail some "laziness" in searching primary sources with the risk of scholar abandoning material archives.

Nonetheless, many important values can be attributed to digital sources compared to material ones. They are related not only to the possibilities of immediate availability and an easier research, but also to the potential of these resources in making comparisons among documents and, above all, in finding unexpected connections among various sources: this possibility is very important for 43% of the sample. In addition, online sources seem to be increasingly crucial as interactive tools for geographical and historical high education.

A question of the questionnaire also tries to make an overall assessment of the perception of restrictions of online tools. When asked "What would you suggest to make the quality of online iconographic resources more suitable for history of cartography research?" heterogeneous answers emerged. If a part of the interviewees reasserted that a major quantity and quality of scans are needed, another part focused on qualitative aspects of the tools to be improved: more contextual information is needed to ensure that maps are not analysed only as single documents and extensive meta-data on how the maps were produced (cartographer, illustrator, author, if there's text, corporate sponsor, publisher, materials).

Also, the survey analysed the scholar's perception of the impact of GeoWeb tools (digital earth models) on their research and teaching activity and, more broadly, on the spread of historical and cultural aspects of cartography. This aspect, in fact, has been considered particularly interesting in being applied to a context in which the sense and the analysis of the representation often prevails over the geographical-territorial datum. Although most answers show a tendency to perceive a certain importance of such tools in the history of

cartography fields, the reasons behind the answers tend to highlight both limitations and potentialities. Many answers tend to indicate that GeoWeb tools are important for spreading historic cartography culture as they help to understand that maps are more than simplistic images and, consequently, they help to spread disciplinary advancements. Their usefulness lies, moreover, in the possibility of displaying and analysing multiple sources without needing specific software. However, GeoWeb tools tend to be intellectually unproductive when the research is concentrated on map languages rather than in the historical evolution of territories. In fact. when analysing the effectiveness of GeoWeb tools for the history of cartography research, most of the interviewees avow not to be interested in those kinds of resources, often seen as dangerous, "Such interfaces - affirms one of the interviewees seem to be useful when trying to find detailed images of a particular region, otherwise they could be misleading for several reasons:

- 1. Promotion of the spatial extent of early maps as their most important aspect, which is historically naïve.
- 2. Establishment of a modern spatial context for each map, denying the historically contemporary context.
- 3. Imposition of a metric of geometrical accuracy, which is generally irrelevant to understanding early maps (it may be relevant, but usually it is not)".

Another perception analysed, focused on participatory resources. In details. the importance of crowdsourced resources as tools for history of cartography research was enquired. User-generated contents have been seen as not relevant tools for research. In fact, 44% of the respondents asserted that they are not important at all or of little use for research. Nevertheless, when asking to list the benefits of those kinds of sources, a series of important potentialities have been listed. It is the case, for example, of their ability to get society more involved with cartography and, above all, the possibility to find fascinating, intuitive tools and a significant amount of material for teaching. Moreover, it emphasises how crowdsourcing seems to speed up the timeline to get materials, their role in identifying ephemeral materials that are not part of special collections. Therefore, although participative tools do not seem to be frequently used in academic research, their role becomes important when shifting the attention on "non-official" cartographies and when considering their impact on the spread of cartographic knowledge in the field of public geography.

6. Conclusions

The present work attempts to help bridge a gap in the present literature regarding the analysis of the impacts that the dissemination of online digital sources has on research in the history of cartography. The understanding of this phenomenon, in fact, is particularly useful on the one hand to establish guidelines, adapted to the context of digital repositories in general, on how they could be organized and structured to the best as tools for research and teaching, on the other hand the study helps to understand the impacts that the availability of free online sources has on academic activity. Finally, the study analysed the ways scholars approach and interpret resources that are in part alien to the academic context - i.e. participatory tools and the new forms of organization of geo-historical data that flow into the so-called GeoWeb or digital earth models. In order to interpret the phenomenon according to a user-oriented approach, the study involved interviewing 22 scholars who were asked to respond to a questionnaire aimed at understanding the perception of how online resources providing free cartographic material have changed the way they carry out their research. It was the first step of a study aimed to analyse the impact of web technologies on history of cartography. Further developments of the research will be carried out by focusing on the theme of metadata, participative tools and GeoWeb with the involvement of a larger sample of interviews, other categories of specialists including (librarians, web-projects managers, etc.). That approach could be useful to analyse the problem on a wider scale and at the same time to propose solutions to the critical issues that the present work has brought to light, especially for what concerns metadata, participative tools and GeoWeb resources.

The present paper shows that the development of digital instruments for history of cartography does not have as sole consequence the immediate availability of the sources. The diffusion of these tools, in fact, used by a verv high percentage of the sample, has first profoundly changed the way sources are searched. The research confirms that Internet is the first place where scholars search for cartographic sources. At this level it is important to note that the efficiency of research tools appear to be one of the major weaknesses identified by respondents, or at least one of the tools for which functional optimization to academic research seems necessary. Evidence of this is the fact that there is no search instrument considered authoritative for a satisfying research. Searching for a document implies both consulting search engines, specialized portals, digital libraries and meta-digital libraries tools. Nevertheless, the relevant role of digital collections and libraries search tools, commonly used as a starting point for sources' research, denotes a perception of a certain scepticism towards the most popular search engines by scholars.

However, the fundamental role of search tools in tracing sources whose existence was unknown emerges. This potential has, in some respects, profoundly improved the chances of fulfilling research activity.

Although scholars strongly point out the general scarcity of high quality metadata on how the maps were produced that would allow a more profitable and conscious use of digital resources (cartographer, illustrator, author, and if there is text, corporate sponsor, publisher, materials), the survey does not reveal a preference by academic scholars for the analysis of material documents but rather a tendency towards a use of both digital and material source for research. Exceptions are research in which the assessment of paper type, use, stains, etc., is relevant. For this reason, the digitisation of materials appears, despite the intrinsic limitations of digital copies, to be an important contribution to research. However, its limitation is identified by the fact that it induces scholars not to attend traditional archives and libraries. As a result, scholars often end up giving priority to what is online and they tend to forget that the search for visuals in archives could lead to the discovery of new documents and to new paths of research.

The study also evaluated the perception of some types of resources traditionally associated with mass culture rather than the world of academic research: GeoWeb and participatory tools. GeoWeb models are thought to be of little use to academic research in the field of history of cartography. Though fascinating for teaching and for divulgation and important for the spread of cartographical culture in society, they are often seen as intellectually unproductive and misleading when researching and teaching focus on map languages because they place their attention mostly on geometrical accuracy and metric aspects of relative importance in history of cartography.

As far as participatory tools, despite a certain scepticism by scholars, considering these tools of not relevant role for research activity, they are considered useful and efficient for a series of possibilities that they offer: they turn out to be useful to find out a significant, although sometimes qualitatively inadequate, amount of material for didactical purposes and they play an important role in identifying ephemeral, previously unknown materials that are not part of special collections. Furthermore, such tools play a crucial role in getting society more involved with cartography. In this sense, GeoWeb and participatory tools represent a relevant, changing scenario for an open, public, history of cartography. The relationship between these tools and the scientific community represents in that sense an intriguing scenario.

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Following the food: the case of Grana Padano

Marco Tononi^{a,c}, Sara Bonati^{b,c}, Antonella Pietta^{a,c}

^a DEM – Dipartimento di Economia e Management, University of Brescia, Brescia, Italy

^b SAGAS – Dipartimento di Storia, Archeologia, Geografia, Arte, Spettacolo, University of Florence, Florence, Italy ^c IRIS – Interdisciplinary Research Institute on Sustainability Email: marco.tononi@yahoo.it

Email: marco.tonom@yanoo.it

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Abstract

The geography of food has recently produced a lot of analysis and theories. The paper covers the recent history of this rich line of research and looks at certain important aspects to produce an analysis which considers the whole food system. The central aim is of connecting consumption (and the new role of culture) with production, its socio-ecological evolution and the environmental impact on the entire food process. The methodology used to link the different phases is "following-food" (Cook et al., 2006). This approach consists in following a certain food through its transformations. This is useful to connect not only consumption and production, but also different dimensions: culture, economy, society, ecology, health. In particular, the paper analyses the links between the foodscape of milk production, focusing especially on Grana Padano PDO cheese in the Lombardy Region. The research has been used in an educational laboratory with a primary school, in which the researchers helped students to discover the local foodscapes of production and consumption.

Keywords: Food, Foodscapes, Following-Food, Grana Padano, Lombardy

1. Introduction

This paper aims to introduce a cultural approach to food chain analysis, adopting a geographical perspective in the field, and to improve students' awareness of eating attitudes. The central aim of these developed activities was to investigate the "interconnectedness" of places (Gold and Revill, 2000, p. 15), by connecting consumption (and the new role of culture) with production (and its socio-ecological evolution) and looking at the environmental impact of the entire food process. The methodologies of analysis we adopted in these educational activities are "following-food" (Cook et al., 2006) and footprint analysis. Between October 2016 and March 2017 the educational project "GeoLab: *alla scoperta del paesaggio geografico*" has been developed with students between 9-10 years old.

The integration of these methodologies has been adopted to answer the demand to integrate consumption and production analysis in food
studies. The different sub-fields of food geography presently only pay attention either to consumption or production. Accordingly, geography needs to reconnect the different elements of the food chain (Winter, 2003; Cook et al., 2006, 2008, 2010). Working in this direction is Cook et al. (2006, 2007, 2008, 2010, 2013; for a review of food geographies see Colombino, 2014) who have proposed the "following-food" methodology (see also "follow the thing" in Marcus, 1995; Hannerz, 2004). The method aims to unravel the links between the different places of food consumption and production with their economies, cultures, histories, art, creativity, nature and communities. It consists in following commodities, ingredients or food from any point in the chain with the aim of overcoming the linearity of the political economy approach (from production to consumption). According to this method, researchers interact both with consumers and farmers, influencing their actions and sharing experiences. On the other hand, the footprint analysis offers a quantitative approach to the issue, useful for a visual representation of their impact.

Thus, we believe that the combination of these two approaches is useful to study the relationships between production, transformation and consumption processes with potentialities in education at different ages. Through the following-food approach, the students can discover the people and places involved in the food chain. Through the footprint analysis, they can evaluate their own impact looking at each phase of the chain.

Therefore, according to the "backwards" and multi-scalar approach offered by this method these educational activities have moved analysis onto the production, transformation and consumption processes of milk, with particular focus on the *Grana Padano* chain. The focus on *Grana Padano* is justified as it is a PDO (Protected Designation of Origin) cheese, which is based in Lombardy. It is one of the main dairy and milk production sites in Italy (Zuccali et al., 2018; https://www.clal.it/?section=razioni-lombardia).

Thus, the paper starts with a brief review of food geography. After this, we introduced the following-food methodology integrating it with the ecological footprint. We then discussed Geolab didactic activities, moving our analysis "over the boundaries of the farm" and following the production and consumption chain of *Grana Padano* through observing the places directly or indirectly involved. As part of the educational activity, the footprint analysis is presented to evaluate the impact of consumers' choices following the entire food process. We have proposed the footprint family focusing on carbon and water footprints as tools to increase awareness of the impact of food systems.

2. Geographies of food: an overview on the topic

The geography of food has obtained significant success and has produced a considerable number of publications, especially over the last decade (Colombino, 2014; Cook et al., 2006, 2008, 2011), discussing food by different perspectives.

Before the cultural shift to consumption studies, food was investigated simply in terms of production in agricultural geography. The agricultural geography analyzed food mainly as a raw material in agricultural activity, something disconnected from the market and its dynamics and focused simply on elements inside a farm's boundaries (Winter, 2003, 2004, 2005). Subsequently, a family of studies, called agro-food geographies (Winter, 2003, 2004, 2005) and described by McDonagh (2014) as rural geographies and food, shifted attention to the market beyond farm boundaries to look at the whole food chain system (Winter, 2003). This approach discusses in particular, the interconnection between "farming and food, food and politics, food and nature, and farmers and agency" (Winter, 2003, p. 510). It focuses on the "farmer dimension" and especially on how farming and farmers are changed by different socioeconomic-political dynamics and how they are evolving as a result of globalization.

With the postmodern turn towards the cultural dimension of geography, a relevant body of the food literature has focused on consumer implications, analyzing the role and culture of consumption (Winter, 2003; Colombino, 2014; Shaw, 2014; Bell and Valentine, 1997; Cook and Crang, 1996). Friedberg (2003) is in this optic of "new cultural geographies of food", such as studies on "foodways", which define attitudes connected with food, for instance what move people when shopping or eating (Alkon et al., 2013, p. 127; Miewald and McCann, 2014). These choice attitudes are the basis of food customs, which are part of the "identity, memory and tradition" of a community that "play a key role in protecting and preserving cultural sustainability" (Williams-Forson, 2014, p. 71).

This new awareness of the consumption dynamics and of the relations between food and socio-cultural interlinks has helped food studies to go beyond the economic point of view and beyond the boundaries of the farm. Nevertheless, we should not forget the political issue, which considers the importance of power relationships in the food system starting from agrofood policy and farmers' condition (see the political ecology – PE perspective in Winter, 2004; Moragues-Faus and Marsden, 2017). According to the PE approach, the environmental impact and relations between the environment and socio-cultural dimensions are important elements to reconnect food production with consumption (Moragues-Faus and Marsden, 2017).

Another relevant approach looks at alternative ways to consume. "Alternative models of production and consumption" (Stassart and Whatmore, 2003, p. 449) are discussed as counterparts to the dominant model. These studies are part of a broad family of studies on "alternative economic geographies" (Goodman and Bryant, 2013) which also involves work on food chains and retailers such as alternative food networks (Goodman et al., 2011; Holloway et al., 2007; Whatmore et al., 2003), global commodity chains, alternative geographies of food, alternative systems of food provision (Watts, Ilbery and Maye, 2005), alternative food practices (Guthman, 2008; Slocum, 2006), and alternative food institutions (Allen et al., 2003).

In urban studies, food has stimulated a rich scientific production, aimed first to understand the role of food in shaping urban space and life (see e.g., the critical geography of urban agriculture, Tornaghi, 2014; and food places by Feagan, 2007). In this group, there are studies on foodscapes (Goodman, 2016; Moragues-Faus

and Morgan, 2015; Johnston et al., 2009; Miewald and McCann, 2014; Morgan, 2010; Winson, 2004; Yasmeen, 1996; see also "urban foodscapes" in Cummins and Macintyre, 2002; Morgan and Sonnino, 2010). The concept is used especially to explain food diffusion in urban spaces (Winson, 2004; Yasmeen, 1996; Johnston et al., 2009). Johnston et al. (2009) define foodscapes as the result of relationships within social, cultural and spatial contexts such as "contested spaces where actors struggle to define the terrain of political action, including the extent of market involvement and private ownership of food" (Johnston et al., 2009, p. 513). Accordingly, Goodman (2016) uses the term to identify the relational dimension of food, sustaining that "food is more-than-food". The author suggests the usefulness of this approach in particular to study inequalities and hunger, connecting this work with the food justice movement.

With the food justice movement (Heynen et al., 2012), are identified those studies which adopt a critical perspective on food implications in human life, and in particular in producing situations of social and environmental disparity. In this group certain subcategories can be identified like black food geographies (e.g., Ramirez, 2014), according to which food movements are often represented as "white spaces" (Slocum, 2006), and food deserts (see also urban food deserts, Breitbach, 2007). These identify places where the access to healthy food is made difficult by high prices and shortage of food providers (Cummins, 2014; Walker et al., 2010). Other perspectives in this field are food security and sovereignty and the social geography of food (van der Ploeg, 2009). In particular, food sovereignty refers to "the right of nations and people to control their own food systems, including their own markets, production modes, food cultures, and environments" (Wittman, Desmarais and Wiebe, 2009, p. 2).

As shown in this literature overview, the complexity of the geographies implied in the food chain has inevitably promoted a sectoral approach. On one side, it is essential for in depth knowledge of the geographical implications of the different phases of food life, on the other one we believe there is a need to adopt an overview. In terms of educational impact, an overview approach has more potential to communicate and promote a critical approach in students and consumers' choices. Accordingly, we decided to adopt the following-food approach.

3. The following-food approach: a methodological proposal

Following-food is a methodology based on the "follow the thing" approach combining actor network theory and the study of social component linked to the life of objects (Marcus, 1995; Hannerz, 2004: Colombino, 2014). Multi-site ethnography is the basis of this method developed, in geography, by Ian Cook (Cook, 2004; Cook et al., 2006, 2007, 2008, 2010, 2013; Colombino, 2014). This implies that we can explore food geographies starting from each point of the chain. The nodes along the chain can reveal different and meaningful aspects for further examination, following various tracks and food footprints (Colombino, 2014). The main topic of our work was to apply this methodology which helps us to move within food geographies, unveiling social, cultural and ecological aspects for educational purposes. Moving within food geographies means describing the different places that connect foods by following them. To follow all the connections, behind, around and beyond a particular food, implies investigating what happens, in the places involved in food production, transformation and consumption in the globalization era. Local is more and more interconnected and influenced by global, not only in terms of markets and logistics but also of human stories and experiences (Cook et al., 2006).

Food narratives are related to these communities and individuals in the different phases of food life and so they represent a really powerful educational tool. Thus, following-food also means considering every point of the chain and describing and mapping the links between these different stories.

Thanks to this methodology, students can explore characteristics and impacts related both to consumption and production. Looking at consumption (Colombino, 2014) we analyzed topics like consumer trends, the concepts behind food, the image of food conveyed by advertising, the

impact of certain diets. Looking at production we focused on aspects like the environmental justice of farming, the economic effects and the environmental consequences of certain agricultural crops and methods (Winter, 2003, 2004, 2005; Moragues-Faus and Marsden, 2017).

Considering these aspects, we gradually discover a number of information, data, stories, places, communities, which all help us to understand the complex system of food and how each part is interconnected with each other. For instance, how the choice of consumers influences the lives of farmers and vice versa. The analysis of these interconnections also considers socioecological justice within the food chain, looking at power relationships and inequalities, studying alternative food networks as processes of rapprochement between farmers and consumers. This means looking at the agro-food system in order to reconnect farms, people, the environand policy (Winter, 2003, 2004; ment, Moragues-Faus and Marsden, 2017).

The following-food methodology has been applied to a lot of kinds of food: fish, beef, fresh veg, fresh fruit, hot pepper sauces, chewing gum, tomato, French bean, papaya (for a complete review of this see Cook, 2004; Cook et al., 2006, 2007, 2008, 2010, 2013). The methodology uses different types of data: qualitative data such as stories and images, and quantitative data such as statistics and data reports. The Geolab project has applied this methodology looking not only at the scientific but also the educational perspective. The workshop activities guided the pupils to discover qualitative and quantitative aspects of milk and cheese considering production and consumption and, thanks to their ecological footprint, the impact of these processes on the places involved.

3.1 A tool to follow food processes considering impact

We decided to join the ecological footprint (EF) to the following-food approach for a number of reasons. The first is related to the potential of the EF to capture relationships between demand and supply of natural resources at different scales, taking into account the links be-

tween production, consumption and transformation processes. The second refers to the potential of the EF to estimate the impact of lifestyles from a global to a regional and local community scale, to that of institutions, enterprises, products and services, as well as to the family and individual citizens.

This multi-scalar representation, together with the ability of the methodology to capture the relationships between different geographical levels, allows us to understand how lifestyles can impact the environment according to a geographical perspective.

The EF is defined as the total area of terrestrial and aquatic ecosystems necessary to provide all the resources needed by the population to live, given prevalent technology and resource management practices (Wackernagel and Rees, 1996; WWF, ZSL and GFN, 2008). It includes both the resources used as input and those needed to reabsorb output (wastes, etc.) produced by the population itself. Thanks to research, the EF methodology has been refined and extended, creating an integrated and coherent system for environmental accounting.

On the supply side is the biocapacity, in other words the ecological supply from natural resources, which represents an estimate of the potential of local ecosystems to provide natural resources used at various scale levels, from the local to the global. On the demand side, first of all, there is the ecological footprint indicator known technically as the Ecological Footprint of Consumption (EFC) as it estimates the usage of ecological resources arising from local consumption and the Ecological Footprint of Production (EFP) which encompasses all global demand that draws on local natural resources (for a detailed analysis see Bagliani and Pietta, 2012). These three indicators make up the Ecological Footprint Analysis (EFA).

This methodology introduces a very interesting perspective, which allows us to consider the relationship between local ecosystems and productive areas located at a great distance. Indeed, the demand side distinction makes it possible to separately identify processes and effects created. On one hand these include those created by consumption considering the pressures generated in any part of the world to produce the goods and services consumed locally. On the other hand, they include those created by production processes, which put pressure on local ecosystems to produce the goods and services consumed globally.

By comparing the supply of a territory's ecosystem resources respectively with the EFC and the EFP it is possible to obtain information on the use of natural resources. Comparing the biocapacity and the EFC, if the local supply of ecosystems is lower than the local demand for global natural resources, then we have an ecological deficit. This provides an indication of the degree of responsibility which a population has for the use (or over-use) of global ecosystem resources. Considering the food component, it means that a population is responsible for both over-using and degrading local cropland, grazing land, fishing and importing the resources from other territories, included those embodied within imported foodstuffs, to guarantee food consumption.

These processes have particularly bad consequences on landscapes in which these resources are located. At the same time, this population is also responsible for increasing GHG emissions, assessed through the CO₂ emissions embodied in food, contributing to worsening climate change as the local forest surface cannot absorb all of them. Comparing the biocapacity and the EFP, if the local supply of ecosystems is lower than the global demand for local natural resources, the situation is over-utilization of local biocapacity and EFP, leading to its degradation. Considering the food component, this means that we are over-using and degrading local cropland, grazing land, fishing ground, to satisfy our food needs with negative consequences on the local landscapes.

The EFA also allows us to estimate trade flows, by helping us to answer questions such as those presented in section 4.1, e.g., where exactly do the soy meal or soybean for our animal feeding come from? This is so if we eat food including commodities from other parts of the world and what are the consequences of this?

Considering the links between production, consumption and transformation processes the methodology provides an in-depth view. This is based on the assumption that for each unit of material or energy consumed, there is a corresponding area of territory capable of providing the resources and absorbing the waste. Considering both direct and indirect consumption of energy and natural resources along the supply chain and the CO_2 emissions embodied in food, this means that the methodology captures, on one hand, consumption of energy and natural resources along the supply chain, such as farming, accounting for all meat, fish, cereals and vegetables consumed directly. It also includes all of the meat, fish, cereals, vegetables and energy used to feed and harvest food products as well as food handling and processing, packaging and transportation. On the other hand, it quantifies the CO_2 emissions embodied in food¹.

Investigating the links between production, consumption and transformation processes, it is also important to consider that today the literature talks about the so called "footprint family". After the development of the EF at the beginning of the 1990s by William Rees and Mathis Wackernagel (Rees, 1992; Wackernagel and Rees, 1996), many other scholars contributed to the development of new indicators maintaining a common baseline consisting in estimating pressure and impact from the amount of resources and emissions required to support human production processes and consumption activities. Hoekstra (2003) introduced the water footprint (WF), which measures the amount of direct and indirect water used to produce each good and service we use. Then, the carbon footprint (CF) (Wiedmann and Minx, 2007) was developed to quantify the overall emission of GHG directly and indirectly caused by an activity or accumulated over the life stages of a product. To conclude, the nitrogen footprint (NF) relates to the cascade of effects generated by the introduction of reactive nitrogen into the biosphere (Leach et al., 2012).

Looking at food, the footprint family can capture not only consumption and production, but also transformation processes along the supply chain through hidden emissions of food. Certain foods release more greenhouse gas emissions and/or nitrogen than others, some foods consume more water and/or release more polluted water than others, some foods consume more ecologically productive land than others. Thus, this methodology can estimate the impact of lifestyles related to food.

4. GeoLab: following *Grana Padano* in a didactic laboratory for the primary school

The dairy agro-food system was adopted in the laboratory for the fifth grade of the primary school at the Istituto Scolastico Comprensivo of Travagliato in the province of Brescia. This Institute, in collaboration with the University of Brescia and the Catholic University of Brescia, promoted the Geolab project, funded by the Fondazione Comunità Bresciana (Call "Cultura 2016"). The project was made up of a series of educational "packages" proposed to the different classes from kindergarten to the lower secondary school. One of these packages was dedicated to the geographical analysis of the food system. The dairy agrofood system is an important element of the local economic system and contributes to shape the rural landscape of the lowland in the province of Brescia. Activities with students were created in collaboration with teachers, and were strictly linked to the territorial evolution of Travagliato.

Travagliato is a small town in the Brescia Province with about 14,000 inhabitants. It is located in the south-west countryside of Brescia (Lombardy region), at the margins of the *Pianura Padana*. Breeding and agriculture were the main activities until the delocalization of industry from the city and other parts of the province. These activities continue to have a central role in local life, shaping the surrounding landscape. Accordingly, the purpose of the activity was to reconnect young people with the local landscape and agricultural traditions, starting with milk and cheese production. *Grana Padano* is based in the countryside area of Lombardy region.

The first part of the laboratory divided the food system into three phases: production, transformation and consumption. In this way, the concepts of local and global food were introduced.

¹ One of the most relevant limits of this methodology is referred to the fact that it only captures CO_2 emissions, ignoring the other greenhouse gases and other food system waste streams. However, another indicator of the footprint family, the carbon footprint, is focused on all the greenhouse gas emissions.

In the second part, the following-food approach was proposed: starting from a bottle of milk, easy and cheap to buy for students' families, the dairy agro-food system was explained (see par. 4.1). Through the analysis of pictures representing the different phases of production, local landscapes involved in dairy production were observed: industrial factories, fields of maize and soy, pasture, farms, stables, cows, etc.

Then, together with researchers, the pupils filled in some datasheets on these topics: the first was about where to buy milk and dairy products, the second on food transformation, labels of quality and origin and the third considered where cows live and what they eat to produce milk. At the end of each sheet, we talked with the pupils and guided them towards the different connections between dairy production and the local context. The pupils discovered how many different landscapes (e.g., Italian, Brazilian, Argentinian) and how many communities are related to the milk in the bottle and to the production of dairy products, such as Grana Padano. In particular, we analyzed the origin of each ingredient and the routes and transformation of food, including the dairy cows' diet, with a critical approach on the local origin of labelled products. The aim was to improve their ability to connect the different phases of food production, transformation and consumption to their own landscapes.

The third part of the activity (4.2) looked at the spaces of food consumption. After an introduction on milk and cheese distribution in the world, attention moved to the retail system. In particular, places of consumption, such as alternative food chains and supermarkets were investigated. Then, some advertisement images have been analyzed to discuss discrepancies between imaginary and real spaces of production/consumption.

The fourth part (4.3) of the laboratory consisted in analyzing the impact of food expenditure considering the whole chain. With the aim of improving community awareness of eating attitudes, we asked the pupils to calculate their own personal water and carbon footprint using an integrated calculator available online. This allowed us to demonstrate that their eating habits are unsustainable and to help them think consciously about what they eat. We gave them practical advice offering insight and solutions for a more sustainable food-consumption pattern.

The responses of the pupils were really stimulating and never obvious. The contribution and collaboration of the teachers were fundamental for the success of each activity.

In the following paragraphs, we report information and data used during the laboratories dedicated to the pupils looking at three main aspects: production and transformation, consumption and the ecological impact of milk and *Grana Padano* cheese. This shows how each part of the food chain could be more thoroughly analyzed and explained to the pupils to produce a scheme based on the following-food methodology.

4.1 How many landscapes do we "eat"? Following *Grana Padano*

The transformation of the agro-food sector, and also of milk and dairy production, in Europe and in Italy is strictly related to the European Common Agricultural Policy (CAP), created in 1962 and changed over its fifty-seven years of life. In the beginning, the role of the CAP was to sustain the production of agricultural commodities through incentives based on increased production. From the 1992 reform and following CAP reforms, increasing importance was attributed to sustainable agriculture and the introduction of eco-conditionalities linked to CAP payments. The role of farmers changed throughout the years, from simple producers of commodities to pillars of sustainability and food quality. The territorial consequences of these changes were evident in the rural landscape, for instance from the mono-cultural landscape of maize in the Po Valley to crop rotation and diversification (EU, 2012, 2017).

Considering the quality of production, the introduction of quality labels is also part of the CAP: e.g., the Protected Designation of Origin (PDO) guarantees the geographical origin, the Protected Geographical Indication (PGI) links the quality to a certain region, and the Traditional Specialities Guaranteed (TSG) underlines traditional character. The disciplinary of production has influenced agricultural techniques, land use, crop cultivation, economic viability, landscapes and ecological impact. Milk and dairy production are an important part of the agrofood system in Italy and in Lombardy Region. The quality of food is a characteristic of Italian food production which means: 166 products with label PDO, 123 with label PGI. In Lombardy there are 21 PDOs and 14 PGIs (ISTAT, 2018). Simply in the province of Brescia there are eight PDO labels and the most important, in quantitative terms, is Grana Padano cheese. The Grana Padano area of production includes Lombardy, Veneto, Trentino Alto Adige, Piedmont and parts of Emilia Romagna. The production and transformation of the milk used for this labelled cheese involves 4,174 producers and 179 companies (ISTAT, 2018). The high-level quality of the product, the local origin and the image created by the brand are the main elements of success.

Working with students on *Grana Padano* during the Geolab certain questions emerged. Below, we present the steps we followed in the educational activity/analysis about cheese production in the farmland.

- Where the dairy cows live.

With the pupils, we opened our analysis observing some advertising images. What emerged was that the images of the dairy production proposed by advertising were often related to certain standardized aspects of rural life: e.g., a happy family or a farmer in a green mountain landscape, where free cows eat grass in the pastures.

We then tried to show the real face of the dairy cows life. Presently, 92% of the cows in Lombardy is reared in lowlands and on intensive livestock farms. The Lombardy region produces 43% of the Italian milk. 40% of this milk is used to produce *Grana Padano* (https://www.clal.it/?section=razioni-lombardia).

- How cows' diet is made up, where the products come from and what about the landscapes of origin.

Ingredients	Kg
Maize Silage	24
Maize mash	5
Grass silage	3
Soy Meal 42% (Protein)	2.8
Maize meal	2.7
Нау	1.3
Italian Ryegrass Lolium	1.2
Alfalfa field dried	1
Barley rolled	1
Linseed expeller	1
Soybean toast	0.8

Table 1. Dairy cows diets example. Source: data from CLAL (https://www.clal.it/?section=razioni-lombardia).

Another relevant indicator we used was the dairy animals-diet. According to this analysis, a map of animal diet can be created and certain relevant questions can be unrevealed. The dairy cows' diet for Grana Padano is composed of a large amount of maize silage, forage made from different types of grass, maize mash, soy meal or grain, maize meal and other ingredients. These elements are mixed and distributed to the cows every day. The example of the daily diet shown in Table 1 is relative to a cow that produces about 36 litres of milk per day.

The maize, for example, is produced mainly in the fields around the farms but partially, it is imported from the EU and other parts of the world. Today the maize crop is typical of the local countryside in the Lombard Po Valley during spring and summer. Analyzing the Lombard landscape of the lowland, we can find fields of grass or alfalfa fields, maize fields and a very few and recent fields of soya beans. The proteins of soy are essential to maintain high levels of production, quality of dairy products and consequently of profit margins.

- Where the soya meal or soya beans for our animal feeding comes from.

We focused on this specific product central to the cattle's diet, soya, to introduce other topics, such as environmental justice and globalization. Contrary to their expectations, the pupils discovered that soya comes mainly from South America, in particular from Brazil and Argentina. In Europe, a growing production of soya is located in Ukraine. Italy imports more than 85% of its consumption (Assalzoo, 2015).

Moreover, they observed that connecting the different landscapes of soya production is complicated. After the 2001 Argentina crisis and the diffusion of the "modelo sojero", the genetically modified (GM) soybean was widespread in Argentina and this contributed economically to soya producers' profits. On the other hand it gave rise to conflicts between traditional local cultivation and the new modelo sojero, with consequences on biodiversity and social justice (Leguizamon, 2013).

Similar situations also took place in Brazil, which hosts the most important rainforests in the world. Considering the WWF report (2014), the pupils learnt about the impact of soya in terms of deforestation and local rural economy and about the potential role of consumers in orienting markets, for instance substituting soya beans with other vegetal proteins or using certified soya. The history of soya in Brazil is in part the history of animal feed in Italy and Europe. Indeed, we are one of the main world importers of soya (WWF, 2014).

- We produce a PDO cheese.

Last step of this activity was focused on a critical discussion of the meaning of labels and their contradictions. Do we do the right thing using commodities from other parts of the world? *Grana Padano* depends both in quantitative and in qualitative terms on the use of soya proteins. The profitability of local farmers in Lombardy depends on soya meal and maize silage, which impacts biodiversity, water consumption, use of agrochemical products and fertilizers. The equilibrium between nature, economy and socio-cultural conditions of farmers is complex.

The farmers' tales in Lombardy reflect socio-ecological changes in techniques of cultivation and animal feed, cultural consciousness, agricultural policies and consumption choice. Today when we talk about food the key aspects are sustainability, local origin and quality. To reduce the impact of cheese production we must consider not only the local impact of farmers' activity but also the socio-ecological effects created all around the world importing commodities. The excellence of the Italian *Grana Padano* is made with the aid of Latin America's farmers. These interconnections could undermine the local origin of this cheese and open a critical analysis on foods labelled as local.

4.2 Consuming Grana Padano

After the production analysis, the pupils were questioned on the consumption dimension. This discussion started with an analysis of the local diet. Diet analysis is fundamental in the following-food approach because it allows us to understand the geographies of food consumption. Accordingly, we "broke down" *Grana Padano*, focusing first on milk consumption geographies. Thus, the role of milk and derivatives was considered, with some statistical data, to understand the weight that it presently has in different geographical contexts.

According to this analysis, milk and derivatives play a central role in Western countries, in North Africa and South America (FAOSTAT, 2011; Pulina et al., 2011). Recently, the consumption of milk has diminished especially in developed countries; among the causes there is the increasing of intolerance (Zingone et al., 2016). According to the Canadian Dairy Information Centre², the consumption of fluid milk in Italy has been reduced by about 10 litres per capita between 2010 and 2017, with a constantly negative trend. The same trend has been registered in other European countries such as the Netherlands, France and Spain. The consumption has been relatively constant in the United Kingdom and Germany, and is increased in a few countries such as Luxembourg and Lithuania. Negative trends have been registered also in

² Global milk consumption (litres per capita). Available at: http://www.dairyinfo.gc.ca/index_e.php?s1 =dff-fcil&s2=cons&s3=consglo&s4=tm-lt.

extra-Europe countries, such as Egypt, Iran, Argentina, Brazil and North America countries.

On the contrary, consumption of cheese is increased in almost all countries evaluated by CDIC, with only a few exceptions. In Italy, France and Switzerland the trend is constant. That is probably due to the stable presence of the product in the traditional diet. In any case, per capita consumption of cheese in Italy (22.2 Kg in 2017) is one of the highest in the world. It is also higher than the European average (18.7 Kg in 2017).

European countries have the highest levels of milk and cheese consumption in the world. Five countries surpassed 100 litres per-capita in 2017. Outside Europe, these levels have been reached only by Australia and New Zealand. In cheese consumption, the European countries are the only ones to go over quota 20 Kg per capita. This is the case for Austria, Cyprus, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Sweden, Switzerland, Iceland (the first consumer) (CDIC data, March 2019).

So the pupils focused on *Grana Padano*, trying to understand its diffusion and consumption trends. The demand for *Grana Padano* has increased over the last decade, with 38% exported (Bava, 2018). According to CLAL-ISTAT data, export of *Grana Padano* and *Parmigiano Reggiano* has increased by about 25% since 2012. It has increased 20% in extra-EU countries, and 29% in the European Union. The main destinations are Germany, United States, France and United Kingdom.

At this point, a cultural dimension was added to the analysis. Consumption of these cheeses is part of the Mediterranean diet and Italian cuisine, integral to the Italian table. In the same way, many European countries are culturally associated with the production and consumption of cheese or milk derivatives. This is the case of France, Switzerland and Greece. A study of the Catholic University of Piacenza also showed the positive health effects of consuming *Grana Padano* in reducing blood pressure (Crippa et al., 2011).

The pupils were then asked about the role of consumers and on the power of their choices. As observed in the production analysis, the livestock industry has a relevant impact on climate change, and dietary choices can have a powerful role in directing the market. According to Macdiarmid et al. (2016) concerning meat, there are three aspects that should be considered in consumers' answers to advertisement on dietary impact, lack of awareness, the perception of the impact of personal consumption and distrust to change. We could also add the distrust that individual choice could have a meaningful influence on the market and economic system of production and distribution.

As the FAO states, sustainable consumption can contribute to a better quality of life (Norwegian Ministry of Environment 1994, cited in Black and Cherrier, 2010, p. 438). The responsibility of consumers' choices is a central element in shaping the consumption system and its sustainability (Meulenberg, 2003). Thus, the first step should be to change consumers' perspective and as a consequence, their individual daily life behaviour (Tononi et al., 2017; environmentally aware citizens see also Ottman, 1993). Dietary choices are the first aspect to consider.

The role of consumer consciousness or awareness is also recognized by Blake et al. (2008), Macdiarmid et al. (2016), and Pohjolainen et al. (2016) and for strategies suggested by Apostolidis and McLeay (2016) there is consumer education (others include financial incentives and regulatory mechanisms).

Consequently attention has moved to the question *how can we define a sustainable diet?* For this purpose, the definition provided by FAO (2010, p. 10) is useful. In particular, it states "diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and nutritionally adequate, safe and healthy; while optimizing natural and human resources".

Thus, FAO does not limit the definition to an environmental dimension, guiding us towards a multi-dimensional interpretation of diet that considers different levels of sustainability and landscapes. In this definition, the connection between food and culture is strong and an analysis on food cannot ignore the cultural role that it plays in society. Moreover, the impact of our diet in environmental terms, is a key topic to complete the analysis of the food chain as described in the next paragraph.

4.3 How to estimate the impact of food chains

To complete the analysis of the complexity of the food system, reconnecting the different elements of food chains, we decided to use the Ecological Footprint Analysis looking at footprint family indicators.

According to the literature, different approaches and methodologies are used to define and calculate the "foodprint". Birney et al. (2017) define a foodprint as "the resource and environmental impact associated with an individual's eating habits and choices". Goldstein et

al. (2016) talk about urban foodprint as the various elements of diverse resource consumption and environmental impact associated with the production, processing, distribution and waste generation of food demanded by urban residents. Other authors only focus on the GHG contribution, so the foodprint concept refers to the total amount of GHG emitted through "growing, rearing, farming, processing, transporting, storing, cooking and disposing of a food" (Abrams, 2014, in Kim, 2017, p. 366).

In our didactic laboratory, we showed the pupils the relevance of their personal foodprint, which depends on diet. Starting with the previously mentioned FAO definition of sustainable diet (FAO, 2010), we introduced the food pyramid and the environmental pyramid (Figure 1) explaining the direct relationships between food impact on health and the environment.



Figure 1. The food pyramid and the environmental pyramid. Source: Barilla Center for Food Nutrition (www.barillacfn.com/it/divulgazione/doppia_piramide/).

In doing so, we introduced how the EF and the NF work, and which elements of the food chain can be captured and connected. We also used the WWF online calculator on "the environmental cost of household shopping" (http://www.improntawwf.it/carrelloENG/), focused on the WF and the CF. This personal calculator is particularly useful from an educational point of view in analysing the impact of food daily life choices from a geographical perspective considering the whole chain. Comparing the impact of a meal predominantly based on meat with one predominantly based on cereals and vegetables allowed us to demonstrate that the pupils-eating habits were unsustainable and to help them think consciously about what they eat. In particular, we followed the Grana Padano process through a bottle of milk focusing on the different results in terms of water and carbon footprint. As a consequence of the issues discussed in the previous paragraphs, compared with vegetables and fruit, meat and dairy products have a larger foodprint consuming more energy and resources and emitting a relevant share of CO₂ through longer periods of production, processing and transportation. According to this calculator, to produce 1 L of milk you need 1,033 L in terms of water footprint and 0.24 Kg CO_{2eq} in terms of carbon footprint; to produce 1 Kg of beef meat the contribution in terms of water footprint is equal to 15,503 L and in terms of carbon footprint is equal to 6.32 Kg CO_{2eq}; 1 Kg of potatoes implies 289 L of water footprint and 0.21 Kg CO_{2eq} of carbon footprint.

Thus, our methodology offered a number of relevant findings from the geographical point of view to discuss with pupils. To conclude, we gave them practical advice offering insights and solutions for a more sustainable foodconsumption pattern. We also explained that personal dietary choices can collectively change consumption forces to improve the environment.

5. Conclusions

This paper is an experiment in reconnecting the different parts of the food system. It also has some important educational aspects. The dissemination of results to the community starts from the school as a key factor in food and sustainability education. The research project and proposed laboratory has given a role to culture in agro-food systems, promoting education and knowledge inside the community about the production system and socio-ecological consequences of the entire food cycle.

Understanding the elements involved in the food system could also reduce the distance between consumers and farmers, both in geographical and in cultural terms. The idea to join the "following-food" methodology to the EF was useful in creating a foodscape analysis of the local and global landscapes and territorial dynamics of the agro-food system linked to dairy production. In particular, it was possible to connect cultural aspects, from plate to field, with environmental problems, social and ecological justice, ethical or health consequences of food choices and, to conclude, to think about possible solutions to reduce impact. The aim of our work was to stimulate a critical approach to food geographies starting with the new generations of food consumers and producers. This was to understand what and who is behind food, to know the stories of the people, places and nature that feed us on all scales, connecting local and global.

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Mapping Local Resistance to Anti-Immigration National Law: A Carto-Essay

Cristina Del Biaggio^a, Tania Rossetto^b, Edoardo Boria^c

^a Pacte Research Centre, Université Grenoble Alpes, Grenoble, France

^b Dipartimento di Scienze Storiche, Geografiche e dell'Antichità, University of Padua, Padua, Italy

^c Dipartimento di Scienze Politiche, Sapienza University of Rome, Rome, Italy

Email: tania.rossetto@unipd.it

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Abstract

This article revolves around a map titled *Resistenze locali al Decreto Salvini [Local resistance to the Salvini decree]*, which was created with OpenStreetMap by geographer Cristina Del Biaggio on the 5th of January 2019. The map aimed to dynamically visualise local protests arising against the new legislative decree on immigration and security approved by the Italian Senate in November 2018 (the so-called "Salvini decree"). Soon after its first appearance, the map had been circulated within national newspapers' and magazines' online articles, NGOs' webpages, blog posts, Facebook, and Twitter comments. Adopting an experimental format, this article is assembled in the form of a "carto-essay" which includes: original texts by the mapmaker (Del Biaggio C.), comments by curators (Rossetto T. and Boria E.), and a series of screenshots capturing moments in the map's life. Written on the spur of the moment and following the impulse to grasp in real time the rapid "movement" of a map and the spatial political statement it bears, this carto-essay alludes to questions such as the possibilities for a *cartographic* academic public engagement, the importance of feeling cartographic data in the public sphere, and the opportunity to provide progressive cartographic imageries of the nation.

Keywords: Carto-Essay, Cultural Cartography, Migration Crises, Mobility of Maps, National Map, Protest, Public Engagement, Salvini Decree

1. Premise: The carto-essay format

This article is framed using an experimental and creative format, the "carto-essay". This format is an adaptation from the better-known format of the photo-essay, which has already been experimented with in geographical research and in geographical academic journals (Cronin, 2011; Edensor, 2008). Photo-essays provide authorial, selected, and designed collections of photographs where photos are purposefully arranged, deployed, and assembled with texts to support an argument. The pictures are not aimed at providing a complete documentation of a phenomenon; instead, text and images are deployed in such a way as "to maximize their communicative or expressive potential" (Banks, 2007, p. 98). Within a photo-essay, a sequence of pictures is usually sutured by brief narrative paragraphs to emphasise a set of messages (Bignante, 2011, pp. 94-99). For Ryan (2003, p. 236), who invited geographers to take this technique into consideration, the ideal photographic essay consists of a combination of photographs and text that uses "visual images not simply as illustrations or as some foil for textual theory but as a mode of argument and creative performance". In a similar way, the carto-essay is here intended as an assemblage of brief texts and maps purposefully arranged to creatively convey, rather than merely document, a mapping experience. Assemblages of maps and texts may be found in hybrid forms, such as creative writings embedding maps (Greene, 2011), verbovisual texts merging maps and academic writing (Krygier and Wood, 2009), or photo-essays devoted to cartographic objects (Rossetto, 2018). In the present article, the carto-essay is made up of pieces of academic and non-academic writings and screenshots of maps appearing on the Web. In particular, this carto-essay takes in consideration: a singular map and different versions of this same map as they appeared in several contexts after its first appearance; existing and elicited texts by the mapmaker (Del Biaggio C.); and comments by curators (Rossetto T. and Boria E.).

2. The map Resistenze locali al Decreto Salvini [Local resistance to the Salvini Decree]

In November 2018, the Italian Senate approved a new legislative decree on immigration and security. The so called "Salvini decree" (in reference to Matteo Salvini, the Interior Minister who is behind it) introduced several restrictions to the existing asylum and refugee protection framework.

As the ECRE (European Council on Refugees and Exiles) Weekly Bulletin reported (see https://www.ecre.org/salvini-decree-approvedby-italian-senate-amid-citizens-protests-andinstitutional-criticism/),

the law includes amendments in qualification and reception provisions, abolishes the hu-

manitarian protection status and restricts access to accommodation in SPRAR (Protection System for Refugees and Asylum Seekers) hosting facilities. Several detention and procedure-related amendments also predict significant changes in asylum standards and living conditions, while the decree includes provisions that make expulsion of aliens and citizenship revocation easier.

The impact of these measures on the rights of asylum seekers and refugees has been subject to institutional criticism, with statements coming from the United Nations Refugee Agency and the Council of Europe's Commission for Human Rights. Criticism has also arisen from inside Italy and in particular from the mayors of several cities both large and small.

On the 5th of January 2019, the growing resistance to the immigration and security decree was visualised by a map titled Resistenze locali al Decreto Salvini [Local resistance to the Salvini decree] and authored by Italian-Swiss geographer Cristina Del Biaggio. The map first appeared on OpenStreetMap (http://umap.open streetmap.fr/fr/map/resistenze-locali-al-decretosalvini_279671#16/45.6160/8.9489), providing links to online news regarding local initiatives against the decree for each point of resistance marked on the map. On the 9th of January, it was then published in French, Italian, and German on the website *visionscarto.net* – an online hub hosting critical reflections and experiments dealing with cartographic visualisation with a particular focus on participatory mappings, radical cartographies, and narrative or activist projects employing cartographic language and imagery (see https://visionscarto.net/italie-resistances-municipales and Figure 1).

The map appeared together with the following article authored by the mapmaker and titled *In Italia, dei sindaci si oppongono alla politica di chiusura degli Stati* [In Italy, some mayors are opposing resistance to the closed border policy adopted by States].

When the State fails to address its responsibilities, may an alternative come from the Municipalities?, Filippo Furri asked in issue n. 81 (Fall 2017) of the journal Vacarme. The answer is "YES".

To demonstrate this, Furri uses the example of the shelter cities network, with forerunners such as the city of Venice. A network that is increasingly expanding and strengthening.

Today, other cities, in Europe and outside, are joining the network. The network of the resistant municipalities or "sanctuary cities" started to be woven during a meeting coordinated by the mayor of Barcelona, Ada Colau, in June 2017. The Fearless Cities network includes one hundred members worldwide.

In opposition to the Nation-States' rhetoric of the closed border, openness is organised at a local level.

In January 2019, in Italy, some municipalities began self-organising and sharing the experience of opposing resistance to the legislative decree on Security and Immigration approved by the Government in September 2018. As the days pass, new points appear on the maps to say "YES" to the reception of refugees. Points that, little by little, form a network that opposes populism and xenophobia.

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To date, one hundred mayors have decided to say "NO" to the laws dictated from the "Lega and Movimento 5 Stelle" coalition. The first to oppose resistance have been the mayor of Palermo, Leoluca Orlando, and the mayor of Naples, Luigi De Magistris. Orlando decided to disobey by announcing the suspension of the "Salvini's Decree" and its inapplicability to the city of Palermo. He announced that his municipality will keep registering in the civil registers persons that obtained their residency permit for humanitarian reasons, a protection that has been (un)justly abrogated by the decree.

(Cristina Del Biaggio, originally in French; https://visionscarto.net/italia-resistenza-sindaci).



Figure 1. Publishing the map. *Resistenze locali al Decreto Salvini [Local resistance to the Salvini decree]*, by C. Del Biaggio. Source: https://visionscarto.net/italia-resistenza-sindaci, screenshot.

The map, created with OpenStreetMap, also appeared on the platform seenthis.net together with some posts by the mapmaker (see https://seenthis.net/messages/739544). Presented paired with a similar, preceding map showing the protest against the Salvini decree published by the ANSA news agency, the new map aimed to enhance the previous fixed and static one in terms of dynamism and continuous updating (Figure 2).



Figure 2. Posting the map. Source: https://seenthis. net/messages/739544, screenshots.

3. Eliciting the cartographic gesture

As we will see, this activist map authored by a geographer based at the Université Grenoble Alpes has attracted wide attention in the media. Notably, the Association of Italian Geographers (AGEI) promptly mentioned the "map in progress" on the website of the association on the 9th of January 2019, due to its connection to current political affairs and related burning debates. From the angle of cultural map studies, this initiative, which holds affinities with forms of cartographic protests or counter-mappings (Rundstrom, 2009; Wood and Krygier, 2009), holds particular interest as a cartographic gesture coming from academia but aimed to intervene in the public sphere at a national and international level. Indeed, the protests are local, but the cartographic means helps in visualising their national shape, both materially and conceptually.

Radical scholars developed harsh criticism towards traditional cartography, and are experimenting with alternative cartographic practices (Crampton and Krygier, 2005; Herb et al., 2009). Anglo-Saxon literature speaks of "resistance maps" and "resistance mapping" to indicate cartographic practices and purposes which are alternative to the official line (Dorling, 1998; Crampton, 2003). The expression "countermapping" assumes the same antagonistic value in the face of official cartography, but in general it is used to indicate projects of identity and local environmental promotion which employ cartographic practices that are specifically adapted to those needs, and therefore opposed to traditional practices imposed externally (Sparke, 2005; Webster, 2001; Mohr, 2006; Harris and Hazen, 2005).

Del Biaggio's map is not properly a form of counter-mapping: it does not counter cartographic conventions or aspire to give shape to a counter-world by using cartographic conventions (i.e. the two main strategies of counter-mapping). Del Biaggio's map is perhaps more akin to a protest map. This map does not propose a new world; rather, it asks that we look at the world anew: it is the way facts are framed, as Wood and Kryger (2009) suggest. Indeed, in mapping data (i.e. the local protests), Del Biaggio provided a spatial framework, and a related political statement, for these data. Moreover, since these data are precisely the locations of protests, this map could also be seen as a kind of map "of" or "to" protests (a map materially showing how to get to a protest), which Wood and Krygier see as a cartographic genre appearing in the register of the street. Rescaling the *map to protest* to a national register, Del Biaggio's map seems to invite other social actors to join the protest and to feel united within a national context.

The curators of this essay asked the mapmaker to describe her cartographic practice, the genesis of that mapping gesture, and the phases of its development from both technical and experiential perspectives. Asking mapmakers about their practices, observing cartographic performances, and applying other kinds of ethnographic techniques to cartography is indeed a recent and highly promising field of research for cultural map scholars (Kitchin, Gleeson and Dodge, 2013; Boria and Rossetto, 2017; Duggan, 2017). In what follows, Del **Biaggio's** autoethnographic notes are reported (originally in Italian).

About the "cartographic gesture" per se, I have not so much to say... Unless that it is something like a professional automatism. You read some information and start asking: Will it have some spatial/territorial significance? What if we were to put it on a map? What will happen?

This is what I did that Saturday morning, without thinking about it too much. And with rudimentary tools (tools which can be used by any person, such as the application umap on Open Street Map).

Because, despite the fact that I am a geographer, I am not a cartographer. So, actually, I am not able to make maps. So I do what I can, and get in touch with colleagues that are much more expert than me (as in the case of the team of Visionscarto, for instance).

Then, gradually, since Sunday the little points started to become more and more, and then the map started showing some things, to let a reality, which had remained hidden and invisible until it was mapped, emerge.

I started reading articles explaining that this or that municipality was opposing resistance to the decree, but that an overview of the entire phenomenon was lacking. Well, I thought, this is what the map allows for: to let a network emerge; to make the people fighting against the closure feel less alone.

And the little points are located all along the Boot: from North to South there is someone who says no.

That's all, in the end.

The social networks did the rest.

The aspect which remains to understand (but I will not be able to work on it) is:

Has the map allowed some mayors to come out of hiding? I don't think so.

Will this map allow mayors, municipality members or citizens to get in touch and join in a network? Perhaps it will. I know that it has been useful to Gianfranco Schiavone of the ASGI association (Associazione per gli Studi Giuridici sull'Immigrazione) to contact people in order to build networking. He told me so.

To all these questions, which are essential to understand the value of a "cartographic gesture" that wants to be a counter-cartography, or a critical cartography, I have no answers.

4. Mediating cartographic resistance: following the map

As recent post-representational approaches suggest, cartography may be researched also by unfolding mapping practices (Kitchin, Gleeson and Dodge, 2013), attending to the "biographical qualities of maps", and analysing their social lives and "complicated afterlives" (Oliver, 2016, pp. 79-80). Soon after its first appearance, the map of the local protest against the Salvini decree was circulated within national newspapers' and magazines' online articles, NGOs' webpages, blog posts, Facebook, and Twitter comments. The map initially attracted specific interest in the mapmaker's personal initiative (Figure 3).



Figure 3. Telling the story of the map. Source: http://www.vita.it/it/article/2019/01/08/i-comuni-resistenti-al-dl-sicurezza-sono-piu-di-100-la-storia-della-ma/150278/, screenshot.

Local resistance to Salvini's legislative decree, 100 and counting. In a few days more than one hundred Italian Municipalities advanced clear actions against the application of the legislative decree on immigration and security which was enacted by the Italian Government in the Fall of 2018 and is raising serious concerns for its impact on the rights of migrant people. From Palermo to Florence, just to mention the municipalities of the major cities, to small villages all along the Boot, "every municipality is acting by itself but feels stronger because it is not alone", Cristina Del Biaggio explains. She is an Italian-Swiss university researcher and professor working at the Institute of Urbanism and Alpine Geography of the University of Grenoble. Last Saturday, she made a dynamic map of the municipalities opposing resistance to the decree primarily advocated by the Minister Matteo Salvini. A map which, as the hours pass, became filled with red points and now makes visible the growing dissent of Italian mayors of different political colours.

"In my work I adopt a distant gaze on social phenomena", Del Biaggio, who is working on European borders, explains. This is not to say she adopts a cold gaze, "because I know well to what extent a map may be important for the life of people: the map brings them into a network". Indeed, this is happening with the map in question: "Local phenomena are often 'invisibilised', made invisible if compared with national ones. Instead, maps such as this make these phenomena visible and therefore open to the act of interpretation", Del Biaggio continues. A kind of positive emulation, which is crucial to those who see the decree as an attack on the rights of migrant people: "The mayors and citizens see that their refusal of the decree is not isolated". The map includes different categories of "resistance": total resistance, partial resistance, resistance wanted directly by the mayors, and resistance emerging from actions of citizen groups and associations.

The Italian-Swiss researcher is working in contact with colleagues from all over Europe. "Everyone must pull in the same direction because on such a sensitive theme competitiveness cannot exist: we must make visible things as they are because what is missing in the current surplus of information is access to authoritative and clear sources", Del Biaggio adds while expressing her worry about the route taken by European governments concerning the closure of borders.

(Article and interview by D. Biella, 8 January 2019, originally in Italian. Source: http://www.vita.it/it/article/2019/01/08/i-comuni-resistenti-al-dl-sicurez-za-sono-piu-di-100-la-storia-della-ma/150278/).

After the publication of Del Biaggio's map, very soon cartographic visualisations of the local resistance to the Salvini decree traversed the Web (from Twitter to national newspapers), being hosted in contexts of different political backgrounds, from those valuing the protests and Del Biaggio's "beautiful map" (Figure 4) to those favouring the decree against the "rebel mayors" (Figure 5).



Figure 4. Sharing the map. Source: https://twitter.com/BaobabExp/status/108203714032 4868098, screenshot.



Figure 5. Acknowledging the map on national press. Source: http://www.ilgiornale.it/news/politica/decreto -salvini-i-sindaci-ribelli-si-contano-spunta-mappa-1625453.html, screenshot.

The map also became a tool to recall the resistance beyond its concrete presentation: in the webpages of *Internazionale*, the map lives in the form of a mere link (Figure 6).



Il decreto immigrazione e sicurezza, diventato legge il 27 novembre del 2018 con l'approvazione in parlamento, suscita divisioni e critiche sia all'interno della maggioranza sia tra le file dell'opposizione. Dopo l'attacco del sindaco di Palermo Leoluca Orlando e del sindaco di Napoli Luigi De Magistris – che hanno annunciato di non voler applicare la legge, perché "è un testo inumano che viola i diritti umani" – molti altri sindaci hanno detto che boicotteranno la norma. Una mappa compilata dalla ricercatrice Cristina Del Biaggio raccoglie tutte le adesioni degli amministratori locali contro il decreto, in totale un centinaio.

Figure 6. Linking to the map. Source: https://www.internazionale.it/bloc-notes/annalisa-camilli/2019/01/09/residenza-anagrafe-decreto-sicurezza, screenshot.

Beyond its proper visualisation, the map has come to symbolise an anti-racist standpoint (Figure 7). Living in the Web through different forms of mediation, the map began not only to attract comments but it came also to activate relations and "inter-actions" (Figure 8).



Figure 7. Symbolising the map. Source: http://www.cronachediordinariorazzismo.org/resisten ze-locali-al-decreto-immigrazione-e-sicurezza/, screenshot.



Figure 8. Stimulating inter-actions through the map. Source: http:// http://www.ciaconlus.org/la-mappainterattiva-di-chi-dice-no-al-decreto-salvini/, screenshot

Facebook comments relaunched the map, which came to function as a sort of imaginative projection for people opposing the antiimmigration decree. In other words, as in the comment reported below, the map showed something of an invitational quality as if it were able to stimulate further protests: the map was inviting local actors to take part in it (Figure 9). The cartographic visualisation of those data was provoking emotions (Kennedy and Hill, 2017) (Figure 10).



Figure 9. "*Empty space on the coast of Tuscany, except for Livorno. We need to gear up*". Source: https://www.facebook.com/checca.zampagni/posts/22 23136234372828?notif_id=1547104754775560¬i f_t=mention, screenshot.



Figure 10. "*Resistance does exist and you can see it!*". Source: https://www.facebook.com/cospeonlus /posts/10156809496552225, screenshot.

5. Unaware cartographies: To conclude

This carto-essay has been written on the spur of the moment, following the impulse to grasp in real time the rapid "movement" of a map and the spatial political statement it bears.

Many reflections could be made about the role of counter-mappings within academia, the possibilities for a *cartographic* public engagement, the importance of feeling cartographic data in the public sphere, or the opportunity to provide progressive cartographic imageries of the nation. By displaying moments in a map's life, this essay just wanted to provide an open space for cartographic thinking, experience, and intervention.

Nonetheless, as curators, we would like to advance a brief final reflection. We were particularly touched by the following words of Cristina Del Biaggio: "So, actually, I am not able to make maps". This sounds somehow paradoxical; despite the attention given to *her* map, she feels unable to make maps. Del Biaggio belongs to the main category of contemporary cartographic communication, namely the category of the *produsers*, which came to upset the given distinction between producers and users (Budhathoki, Bruce and Nevodic-Budic, 2008; Coleman, Georgiadou and Labonte, 2009). Yet, the intrinsic normalising power of cartography, whose rigid, formal apparatus of rules and protocols was established during a long tradition, still persuades the non-specialist that official cartographic sources are the sole legitimate ones. We have recently exited a durable and rather conformist historical phase in which cartographers were those with a specific cartographic formation and entered a new anarchist and creative era in which self-taught cartographers obtain full public recognition (Gerlach, 2018). However, in the story of the map against the Salvini decree, there is little awareness of either this change or the crucial role played by all those "unaware cartographers" who commented upon and circulated Del Biaggio's map. We need to raise awareness of this because of the ethical dimension of cartographic acts. Those unaware cartographers handle a powerful tool for interpreting reality – a kind of representation that has the potential to affect public debates about the relational spatialities that are embedded in contemporary social phenomena. Indeed, if Del Biaggio would have used other forms of expression, she would likely not have reached the forcefulness of showing a network of resistance. An online or printed article or a visual product, such as a video or photographs, would have been unable to either give an incisive networked shape to that protest or emphasise and activate the connections between the insurgent local actors. A list would have been insufficient for both providing a sense of the national dimension of the protest and inviting additional protesters to fill the gaps in the map. Instead, once put on the map, Del Biaggio's call broke through.

In the current bulimic and overcrowded communication arena, maps seem to have great potential for communicating the spatial dimension of social phenomena, while the abovementioned revolution towards an anarchic and creative cartographic expression definitely changes the status of cartography within the public sphere. Indeed, Del Biaggio's map is not a counter-map: It is neither a conscious act of rebellion against cartographic conventions nor is it the creation of a reality that is parallel to that circulated by what we once knew as official or standard cartography. Rather, it is a counter-power that is exerted through cartographic modesty.

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GEOGRAPHICAL NOTES AND (PRACTICAL) CONSIDERATIONS

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Not only mermaids. Sea imaginaries by Italian pupils pursuing ocean literacy

Enrico Squarcina^a, Valeria Pecorelli^b

^a Dipartimento di Scienze Umane per la formazione "Riccardo Massa", University of Milano Bicocca, Milan, Italy ^b Dipartimento di Diritto, Economie e Culture (DiDEC), University of Insubria, Como, Italy Email: enrico.squarcina@unimib.it

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Abstract

This work is in line with recent the British and American ocean academic debate and aims to develop insights among scholars and teachers with discussions on the sea, ocean literacy and oceanic citizenship. The Authors state the key role played by ocean literacy in the school context and affirm that this is a significant educational tool for stimulating a sense of personal responsibility that contributes to the conservation of water and ocean environments. In so doing, they provide their preliminary findings on children's sea ideas and perceptions which emerged in a piece of work realized by 540 primary school pupils resident in northern Italy. From their representations, in the form of drawings, an idea of the sea is presented which is often stereotyped. This is a meaningful starting point to reflect on the marine imaginary that pupils may develop in the primary school years while the work also sets out to provide a frame to focus perhaps on a more critical and effective geographical and environmental education practice in Italian schools. We believe that the positive image of the sea that most of the children involved in the research demonstrated, can facilitate the task of offering marine environmental education and is well aligned with the guidelines proposed by the current scientific debate on Ocean Literacy.

Keywords: Environmental Education, Human Geography, Ocean Citizenship, Ocean Literacy, Primary School

1. Introduction

Since the mid-2000s, the academic community has been looking into how to develop awareness on the need to change our daily behavior to safeguard pelagic spaces. While it was clear that the sea can provide food, energy, mineral resources and is fundamental for the circulation of goods, it did not still receive the same care and attention as the terrestrial natural spaces. In fact people seem to see very little or no connection between human activities and the future of the ocean (Voyer et al., 2015).

The ocean is a space that for most of its extension is considered by international law (UN, 1982) a common heritage of humanity but endangered by a great number of factors (Moore and Philipps, 2011; Vallega, 1985). If the high sea represents the heritage of all humanity, every individual, as member of the human community, can enjoy the benefits and resources that the sea may offer. The relation between rights and duties is the cornerstone around which the participative conception of citizenship rotates, thus making "oceanic citizenship" possible. In the light of this, an increase of studies on ocean literacy and ocean citizenship can be recorded especially in the English speaking academia since the last decade. Many scholars (Fletcher and Potts, 2007; Fletcher, Potts, Heeps and Pike, 2009: McKinney and Fletcher. 2010a: McKinney and Fletcher, 2010b; McKinney and Fletcher, 2012; Squarcina and Pecorelli, 2017, 2018) have highlighted that in order to modify harmful human behaviour, it is time to develop rational and effective sea knowledge. In Issue 35 (2007) of the Coastal Management Magazine, Stephen Fletcher and Jonathan Potts published an article entitled "Ocean Citizenship: An Emergent Geographical Concept" in which the focus was on affirming the idea of "ocean citizenship". This concept encouraged the general public to adopt informed behavior aimed at safeguarding, or at least, limiting the degradation of the sea. According to Fletcher and Potts, individuals have a responsibility to make informed choices to minimize the impact on the environment because by so doing they can contribute to large-scale improvements in what appear to be insurmountable geographical problems. Similarly, in order to first create and then spread an ocean citizenship, some studies denounce the limits but also possible solutions. For example, the scientific journal "Aquatic Conservation Marine and Freshwater Ecosystems" (Vincent, 2011) highlighted some critical issues that had emerged from previous surveys undertaken in Mexico, Portugal and Ireland, where the lack of awareness and indifference of the respondents on the "world sea" and in particular on the quality of marine waters, the problems of conservation and pollution of the ocean emerged. According to Vincent (2011) the solution was to transform the ocean into something familiar, whose real value was really felt in order to arouse personal responsibility and diminish that sense of "abstract" that the ocean often embodies in the common imagination.

While many studies state that the level of individual awareness is still marginal in this perspective, other research suggests that where the level of knowledge on marine issues is consolidated, individuals tend to adopt virtuous attitudes towards the environment (Fletcher et al., 2012; Guest, Wallance and Lotze, 2015; Haklay, 2002; McKinley and Fletcher, 2010, 2011, 2012; Fletcher and Potts, 2007; Fletcher et al., 2009; Santin and Santoro, 2017; Steel et al., 2005; Voyer et al., 2015). In other words, where ocean literacy is significant and solid, ocean citizenship is favoured.

This is also outlined in the article titled "Ocean citizenship. The time to adopt a useful concept for environmental teaching and citizenship education is now!" (Squarcina and Pecorelli, 2017).

Ocean citizenship derives from a relationship of a space with a territory not being subject to, or at least not in its totality, state jurisdiction, belonging to the entire humanity and to every single individual even if she/he lives thousands of kilometres away and even if she/he has never crossed it or seen it (Squarcina and Pecorelli, 2018). Here, we would like to contribute to the international debate as we believe ocean citizenship must become a new cultural attitude along with ocean literacy.

For these reasons, we encourage sea education actions supported by formally appointed institutions and informal actors. The spread of ocean literacy should recall the attention of all the educational agencies, such as school and school subjects. In particular, as geographers we believe that geography, or that is the study of the relationship between human beings and the planet, is well equipped for an analysis of marine spaces that comprises both cultural and emotional aspects.

Since contemporary pedagogy and didactic practice no longer considers pupils as tabula rasa but individuals with experiential baggage, perceptions and visions of the fantastic and naive world on which to build a real education and a rational knowledge of reality (Nigris, 2003), we considered it necessary to evaluate in advance, how children see the sea and what their relationship is with this space. At the same time we explored the relationship between children and the sea, as a real and symbolic space, the of narratives and inexhaustible theater representations (Squarcina, 2015). We believe that this may represent an indispensable premise to work of educational proposition activities aimed at the affective appropriation of the sea in a perspective of Ocean Citizenship. In other words, rather than investigating the point of arrival of a possible educational activity, we focus our attention on children's previous knowledge and emotional relationship with the marine environment. Starting from these premises and thanks to the collaboration of a group of teachers, activities aimed at promoting the knowledge of the marine surface of the earth have been organized in a number of Italian primary schools. The relationship with a space has been built since the moment a child was born thanks to direct experience, comparisons with spatial representations and narrations. Moreover, near and far spaces are shaped by literature, cinema, and from those all the discourses and narrationsused by human beings (Malatesta, 2015; Squarcina, 2015). As a result, school-age children have also accumulated spatial experiences from which to broaden their world knowledge. Therefore, it was decided to analyze the idea of the sea in a group of children attending primary schools living in the continental area of the Po valley. This choice was due to the fact that we believe in the importance of promoting ocean citizenship among those who live far from the sea while stimulating awareness of daily behavior impacts on the marine environment. We also decided to develop additional understanding of ideas of the sea, ocean imaginaries and marine perceptions by analyzing drawings of the children taking part to the research. In fact, from an educational perspective: "Drawing can be both a document to be analyzed to understand the role of space in the life of the child, both a tool for building and structuring spatial knowledge" (Giorda, 2006, p. 33). Similarly, for children the act of drawing represents the concrete expression of their feelings and emotions (Crotti and Magni, 2009; Rolling, 2013) and it allows them to "tell, by drawing, what they could not find the words for if expressed in verbal language" (Constanza, 2007, p. 23). Moreover, it is argued that designing places, environments and landscapes is a tool that has many formative potentials for the active teaching of geography because through pictorial representation, the colors that are used and the details, children explore their living space. In so doing, they take possession of something that from a geographical point of view concerns the development of relations with places, with living space and with the territory (Giorda, 2006).

2. Methodological notes

Given the fact that in primary school years children undergo a rapid and profound psychological and cognitive evolution, it was decided to limit the survey to fourth and fifth grade pupils aged 9 and 10. By this age, they have completed the body schema and have reached the conquest of abstract thought, which leads to "awareness of experience, expanding the ability to re-elaborate experiences in a complex cognitive framework" (Giorda, 2014, p. 33). Secondly, we contacted as many primary school teachers of the 4th and 5th classes as possible to work in the area under observation.

After having explained to them the general meaning of the research we invited the teachers to assign the realization of a drawing to the students, using the techniques, colours and materials they preferred, in order to represent "their sea".

The purpose was to invite the children to describe the sea in an art work as inspired by their own direct and indirect experiences. The role of the teachers was limited to explaining the assignment to their pupils and to collecting and scanning the drawing for the researchers. In other words, the teachers'role was thought to be as neutral as possible and for this reason during the general explanation we explicitly asked them not to interfere with unrequired suggestions.

On this occasion, we also asked the teachers not to provide any gender indications of the involved students. This was because the knowledge of this data might have induced interpretative research prejudices and somehow it might have moved the attention from the ways of representing the sea environment. 22 of the teachers and trainees of the degree course in Primary Education Sciences of the University of

Milano-Bicocca joined in the research, working with the students.

In Table 1 we can see in detail the name, the district of the villages where the participants of the project live as well as the exact number of pupils divided into classes. A map (see Figure 1) was elaborated by Andrea Soggiu to provide the research with an accurate understanding of the location of those villages where the collection of data took place.

Name of the village	district	Pupils class 4^	Pupils class 5^	TOTAL
Arcisate	VA	28	0	28
Briosco	MB	0	22	22
Caravaggio	BG	53	48	101
Casale Corte Cerro	VB	0	25	25
Cavaria con Premezzo	VA	20	0	20
Cesano Boscone	MI	66	62	128
Desio	MB	18	0	18
Garlasco	PV	0	26	26
Groppello Cairoli	PV	11	0	11
Lesmo	MB	0	19	19
Melzo	MI	19	22	41
Monza	MB	0	25	25
Muggiò	MB	18	0	18
S. Pellegrino Terme	BG	39	0	39
TOTAL		291	249	540

Table 1. Pupils distribution in municipalities and school classes. Source: data elaborated by the Authors.



Figure 1. Spatial representation of schools involved in the study. Source: data elaborated by A. Soggiu.

3. Drawing analysis

Despite the variety of graphic styles and pictorial techniques, the analysis of the drawings has highlighted a certain constancy of subjects and settings that will be dealt with in the following sub-sections. As Widlocher states that the subject of the drawings "is very close to the child's daily life and his experiences" (1992, p. 156) it is believed that a genuine children's sea experience may emerge from their art work. Similarly, methodologically speaking art-based research may provide a tangible understanding and interpretation of our experience within the natural world (Rolling, 2013).

The analysis of the drawings took place in several distinct phases. First of all, the main themes were identified and a grid was subsequently constructed where the most recurring themes were quantified. A qualitative evaluation based on visual elements was then elaborated by the Authors. Finally, the discursive and symbolic values given to the different elements (eg: a smiling sun, the threatening shark, etc.) were analyzed in depth.

3.1 Main subjects

In observing 540 children's sea art works, we firstly noticed a prevailing theme: bathing. 389 drawings represent the beach, intended as a play area, or included in larger representations, with a whole series of typical seaside holiday scenes: sun umbrellas, deckchairs, beach games, buckets and spades, drinks, ice-creams, people relaxing and sunbathing and people swimming. Among the latter, children have the tendency to selfportrait, or, in some cases, a brief text confirms that it is a representation of themselves. This may underline how the pupils' prevailing sea idea is bound to summer and their experience of vacation time spent on the beach as if they were saying "my idea of the sea is beach life" as shown for example in Figure 2.



Figure 2. The sea conceived as a recreational space. Source: picture provided by a school involved in the study.

The second most represented theme is underwater life: 180 drawings reproduce the main theme of the sea floor or a portion of pelagic waters populated by marine animals of different species as seen also in Figure 3. Brightly colored fishes are prevailing, as if they were inspired by documentary films on tropical seas or by the reconstruction of a coral reef habitat in an aquarium. There is no shortage of fantastic elements, such as mermaids or hidden treasures testifying that for children, whether directly experienced or indirectly perceived, reality coexists with fantasy and fantastic storytelling.



Figure 3. Realistic elements and fantastic elements in the description of the sea. Source: picture provided by a school involved in the study.

Another recurring topic concerns sports and games. In fact, 22 drawings portrait people doing water-skiing, beach volleyball, tennis matches, ball games and so on, confirming the predominantly playful idea of the sea. Interestingly, 4 children represented their sea experience by drawing geographical maps; two depicted the Italian peninsula surrounded by the Mediterranean sea; while another presents a picture in which the southern part of Italy is graphically reported including Sicily and Sardinia but Corsica is not represented. Another piece of art work reproduces an imaginative map in which Africa appears on the right of the picture, divided by the sea where a land named with toponymies Brazil, North America and South America. These lands follow each other from top to bottom but are divided by a stretch of sea where we can spot an island on which the pupil wrote: "Philippine archipelago". In these specific cases, pupils' works can be interpreted as an expression of children to whom the sea suggests above all, if not exclusively, themes of traditional school geography: cartographic representation and the denomination of terrestrial regions.

Other drawings can be defined as generic seascapes or as the sum of generic sea related elements, ranging from sushi to ice cream, from sailing to the fish market counter. Although disparate and not connected to each other, these are somehow connected to the sea. Moreover, the idea of 3 students can be considered interesting who represented the sea in relation to disasters and catastrophes. In the first their idea of the sea is associated with a shipwreck while the second student draws a tsunami hitting a city. The third pupil designs a tsunami and a beach on which, however, people are sunbathing and not worrying about what is going to happen. Finally, a boy or a girl instead describes a battle between sea monsters on the one side while helicopters, planes and ships are to be seen on the other. Here we can perhaps identify elements shaped by the influence of the TV news and/or some popular movies.

3.2 The weather

Analyzing the drawings of our students we can say that the sea is associated with warm sunny weather. In 468 out of 540 drawings the sun is always shining, while in only 5 drawings is the sea represented as stormy or on a rainy day. Another interesting element concerns those drawings whose subject focuses on underwater life. Here the sheet has been divided into two parts, in which the lower part is devoted to the presence of fish, in the upper one there is a blue sky and the sun is shining (see also Figure 4). The sun is also present in three of the four works that represent catastrophic events. In a possible interpretation in a psychological key, which goes beyond our field of study we can state that the idea of the sea for the children involved here is linked to the summer season and, in particular, to a lovely, warm and sunny weather.

3.3 The environment

In contrast, pollution is a missing element. As a matter of fact, in practically most of the pictures analyzed, there are no elements that refer to marine pollution. In only one case is a pipeline represented, presumably a sewage pump flowing into the sea. Similarly, in another art work picturing the sea floor populated by smiling multicolored fishes, a plastic bag and a drink can appear.

In someone else's drawing, trash objects such as can appear in the sand on the beach, while in another there is a boat in the sea water with the inscription: "Let's clean the sea". Clearly, although environmental degradation and pollution are often discussed in schools and by mass media, children rarely tend to associate it with their idea of the sea, on the contrary, presenting an idea of an environment shaped by positive values even from an environmental point of view.

3.4 Human activities

Proportionally there are very few drawings that represent, if we exclude the tourist related activities of sunbathing and swimming, the economic activities that may take place by the sea and/or on the coast. 9 drawings depict scenes of professional fishing, 11 drawings represent cargo ships, often put in the background of scenes. Moreover, 20 children chose to include cruise ships in their drawings, 2 of which are named "Titanic". This may prove the fact that elements taken from literature and cinema are mixed with elements drawn from direct experience. In so doing, some narratives become paradigmatic.



Figure 4. Stereotypical representation of the sea. Source: picture provided by a school involved in the study.

3.5 Fantastic elements

As mentioned above, in some of the drawings presented in this study, fantastic and mythological characters have been included in the representations of the sea. So in 8 drawings we can spot mermaids and in other 2 there are characters looking like tritons or like the traditional shape of Neptune. In 8 drawings we can see hidden treasures, while in 2 pictures there is the presence of pirate ships. Finally, 6 works reproduce submerged cities and in 5 other ones, sea monsters are depicted.

3.6 Stereotypes

The representation of the marine environment appears in most cases to have taken into account stereotypes and reflects idealized images of the sea associated with the seaside and summer holidays (as in Figure 2). As previously reported, in most of the children's art works the sun is a prevailing element. It also seems interesting to note that in 206 cases the sunset is included in the sea landscape recalling illustrated postcards or tourist brochures. Another recurring element is the presence, (72 drawings) of palm trees. While this plant widely decorates seaside resorts beaches and gardens, in our school pictures they seem to reproduce an exotic landscape or more precisely an evocative stereotyped "tropical paradise" as represented in Figure 4. Similarly, islands are in 30 drawings according to the model of the tropical advertising "paradise island".

It should also be noted that in 78 cases, dolphins nicely animated the pictures, sometimes in an underwater context, sometimes jumping out of the sea water but never in the proximity of the beach. This element, we may argue, is more iconographic rather than descriptive, as it is a symbol that recalls a stereotypical and idealized image of the marine landscape.

Finally, 220 drawings are populated by birds. Only in few cases did pupils try to describe seabirds in detail, and in most cases they limited themselves to symbolizing the birds' presence by drawing some graphic V to decorate the sky.

4. Conclusions

According to Olivero Ferraris (1973), when drawing a picture children do not reproduce what they see, but what they know about things, they make selections, they leave out elements that they consider unimportant and emphasize elements considered essential even if not visible. This is even more true, in our case-study, as they were asked to draw a picture based on memories and past personal experiences. In describing the sea, the children involved in our research show that they use their direct experience, but also elements that the culture they belong to attributes to this space.

As we have seen so far, the sea is mainly linked to the beach and summer experiences; it is a space characterized by favorable weather conditions, having fun, relaxing, spending time with friends and family, eating ice creams and practicing sports or other ludic activities. The sea is shaped mainly by positive values while
negative aspects, such as storms, pollution, piracy, human trafficking, oil spill disasters are almost absent despite being reported by the news daily.

This type of mental sea representation may provide a frame, a starting point to plan marine environmental education courses. It is necessary to draw up, especially for children who live far from the sea, educational activities aimed at stimulating a more realistic image of this environment. Children should be able to become more aware that the sea is endangered by human activities; it plays a key economic role (Vallega, 1984, 1985); it has a biological complexity.

We believe that the positive image of the sea that most of the children involved in the research demonstrated, may facilitate the task of offering marine environmental education. Moreover, this is in line with the guidelines proposed by the current scientific debate on Ocean Literacy (Squarcina and Pecorelli, 2017, 2018).

In fact, an effective environmental education can only be based on the very object of geographical science: the relationship between human beings and the environment that surrounds them (Malatesta, 2010), a relationship that involves companies, but also individuals, since their tender age (Malatesta, 2015), a relationship deeply influenced by affective aspects, capable of transforming a space into a place (Tuan, 1978) and as such to be loved, to be taken care of. In other words, to transform the sea into a "part of me" (Voyer et al., 2012). A certain level of awareness has already been affirmed among scholars and those employed in English-language education. But what about Italy?

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Pattern of alcohol consumption of adolescents of a provincial town of the Lazio Region (Italy)

Noemi Bevilacqua^a, Massimo Morassut^a, Maria Cecilia Serra^a, Giorgio Casadei^b, Francesca Cecchini^a

^a Council for Agricultural Research and Economics (CREA) – Research Centre for Viticulture and Enology, Velletri (Rome), Italy

^b Regional Agency for agricultural development and innovation of Lazio (ARSIAL), Rome, Italy Email: francesca.cecchini@crea.gov.it

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Abstract

Alcohol consumption in Italy has shown a change in the model of consumption: from a model defined as Mediterranean to a model comparable to that of northern European countries. With regard to teenagers' drinking habits in particular, it is possible to see a new pattern of consumption which is a far cry from that of their peers of past decades. The consumption is concentrated on one occasion and is characterized by the simultaneous ingestion of different alcoholic beverages, often spirits, far from meals. It has also changed the purpose of alcohol drinking from being one of conviviality to the loss of self-control. To study this phenomenon a representative sample of 500 adolescents from the town of Velletri (Rome), was investigated. 76.8% of the sample declared the consumption of alcoholic beverages; 67.1% declared beer, 55.1% wine and 54.1% spirit consumption. The greater alcohol consumption occurs during the weekend, but a considerable number of students also declared that they consumed wine at mealtimes (38.3%). The average age of the first exposure to alcohol consumption is very low: from 10 to 15 and in general the first drunkenness episode occurs at 14. This sample confirms the magnitude of the problem and calls for a further analysis to better understand the phenomenon.

Keywords: Adolescent, Alcohol Consumption, Mediterranean Drinking Pattern

1. Introduction

Alcohol has been produced and drunk in Europe for thousands of years, and it derives from several beverages of different kinds and alcohol content (Anderson et al., 2006). Europe is the region with the highest mean consumption: 11

L/per capita for each adult per year (Anderson et al., 2006). The alcohol consumption habits of Italy, and, more in general, the whole Mediterranean region has been defined as "Mediterranean consumption model". It is characterized by the consumption of moderate amounts of alcoholic beverages, mainly wine, during meals

(Rimm and Ellison, 1995). The study that identified the importance of Mediterranean diet for the first time was the Seven Country Study. This study also recognized the function of moderate drinking at mealtimes in the Mediterranean-style diet for its role in the prevention of cardiovascular diseases (Kromhout et al., 1989; Keys, 1970; Serafini et al., 1998; Farchi et al., 2000; Khemavanto et al., 2014; Bonaccio et al., 2015). Several epidemiological studies show that moderate wine consumption in adulthood reduces cardiovascular morbidity and mortality mainly owing to the polyphenols that exert a number of important biologic activities on the cardiovascular system (Gresele et al., 2011; Arranz et al., 2012; Rifler et al., 2012; Chiva-Blanch et al., 2013). The protective effect could involve the control of postprandial hyperlipaemia reducing the cholesterol oxidation products (Natella et al., 2001; Zern et al., 2005). Other authors have confirmed the specific free radical scavenging capacities of polyphenols derived from the different grape constituents: berry, skin (Falchi et al., 2006; Giannini et al., 2011) and seeds (Moretti et al., 2011; Cecchini et al., 2013; Ky et al., 2015). The positive effect of these beverages is linked to assumptions: moderate drinking two at mealtimes and consumption for adults only. Moderate alcohol consumption is defined in 2-3 alcoholic units for adult men and 1-2 for adult women (INRAN, 2003), an alcohol unit containing about 12 g of alcohol. The importance of age is linked to the considerable presence and activity of alcohol dehydrogenase (ADH). ADH is the hepatic enzyme that catalyzes the reversible oxidation of primary or secondary alcohols to aldehydes or ketones and is essential for alcohol metabolism. This enzyme begins to be present and active in the human body only around 16-18 years of age and is completely developed at around 20-21 (Brunetto et al., 2008; Maninelli, 2011). For this reason, alcohol ingested at an early age could not be completely metabolized and can remain toxic in the body.

Unfortunately, over the years, just as for the Mediterranean diet habits, we have also abandoned the typical pattern of alcohol consumption: moderate consumption at mealtimes has given to phenomena of episodic abuse (Scafato et al., 2009). Alcohol consumption is a serious worldwide public health problem, because of its high prevalence and the important psychosocial and physical health burden caused by its harmful use (WHO, 2015).

Children, adolescents and elderly people are more vulnerable to alcohol-related harm from a given volume of alcohol than other age groups (Hilton, 1987; Midanik and Clark, 1995; Mäkelä and Mustonen, 2000; WHO, 2015). Also, the early initiation of alcohol use (before 14 years of age) is a predictor of impaired health status because it is associated with an increased risk of alcohol addiction and abuse later on in life (Grant and Dawson, 1997; Grant, 1998; DeWit et al., 2000; Kraus et al., 2000; Sartor et al., 2007). Among young people, at least part of the greater risk is related to the fact that, typically, a greater proportion of the total alcohol consumed by them is consumed during heavy drinking episodes (US Surgeon General, 2007; WHO, 2015). With regard to patterns of alcohol abuse in adolescents, the Word Health Organization (WHO, 2015) reported a prevalence of 7.5% worldwide. However, the highest rate of heavy drinking among adolescents is to be found in the European Region (16.5%).

During the last 40 years, the overall pro capita alcohol consumption in Italy has decreased: from 116 L/per capita per year in 1961 to 66.6 L/per capita in 2009 (drafted by FAO-FBS, 2014). But this decrease is associated to a reduction in the consumption of beverages with moderate and low alcohol content. The Italian drinking behavior has often been assumed to protect young people from hazardous and harmful alcohol consumption in contrast with those of Northern European countries characterized by heavy episodic drinking, often with the intent of intoxication (Calafat et al., 2010; Mäkelä et al., 2006). The phenomenon of youth drinking patterns was the subject of some in-depth studies (HBSCa, 2013; Currie et al., 2012; Scafato et al., 2009; Cavallo et al., 2013). Youth drinking patterns seem to gradually merge into a single model characterized by heavy episodes of drunkenness in all European regions including the Mediterranean area and Italy (Calafat et al., 2010; Allaman et al., 2010). Another habit is on the rise among Mediterranean and Italian adolescents: the so-called binge drinking, the drinking of five or more alcoholic drinks in one drinking session (Prina, 2011). This attitude takes the Italian adolescents even farther from the Mediterranean drinking pattern.

The aim of this study is to verify alcoholic behavior in a sample of adolescents living in the suburban district of Rome and to confirm the dangerous drinking direction of Italian peers.

2. Materials and Methods

In Velletri there are 5 secondary schools, the school population of between 14 and 18 was in 2016 about 4700 students. The students in the the first two years were 2500. A representative sample of 500 students was identified by a cluster sampling on the first two classes of one secondary school, randomly selected. The pupils filled in an anonymous questionnaire.

An "ad hoc" questionnaire, based on the literature data and tested in a sub-group of students not included in the sample, was given to the students in order to collect information about alcoholic attitudes.

The questionnaire consists of a series of questions on drinking patterns (such as the kind of alcohol consumed, the attitude to drinking at mealtimes, drinking during the weekend, fasting before drinking) and the binge drinking habit. Finally, each student was asked about the first exposure to alcohol. In addition, the questionnaire was structured so as to divide the sample between abstainers and drinkers. For the present work aperitifs, cocktails and spirits were grouped in the 'spirits' category. Binge drinking was defined as the drinking of five or more alcoholic drinks on one drinking occasion.

The response rate was 85.2% of the sample. The statistic elaboration was run through the Statistic package software (Version 7.1, StatSoft Inc., Tulsa, OK). Frequencies, means and standard deviation were calculated for all the variables, the analysis on the associated risk factor was run testing the significativity by means of the t-Student test and the YATES Chi squares test.

3. Results

The 426 teenagers involved in the study are on average 15 years of age; 48.5% of them are females.

Results show (Table 1) a significant higher $(p \le 0.01)$ wine consumption in males with re-

spect to females, while no significant differences were detected between males and females concerning beer and spirit consumption.

Drinking patterns	Males (%)	Females (%)	All (%)
Abstainers	20.6	26.0	23.3
Wine consumers	67.2a	46.9b	55.1
Beer consumers	68.6	66.4	67.1
Spirit consumers	55.4	53.4	54.1

Table 1. General drinking patterns of the sample, different letters in line indicate significant difference.

Data referred to the attitude of alcohol consumption showed that among wine consumers, 57.4% consume it during the weekend and 38.3% at mealtimes. Among beer drinkers, 77.5% consume it during weekend and only 19.7% with meals. Spirits were drunk during the weekend by 97.1% of the consumers. In all the cases no differences between genders was registered. In general, all the alcoholic beverages were mostly consumed during the weekend.

Table 2 shows the average age of the first taste of alcoholic beverages. Part of the sample tested alcoholic beverages before 10 years of age: 11.1% of sample tested wine, 7.3% tested beer, and 1.2% spirits.

First taste	Age (years)	
Wine	11±3	
Beer	12±2	
Spirits	14±1	
Drunkness	14±1	

Table 2. Average age of first taste of different alcoholic beverages. Mean values \pm standard deviation.

We underline that alcoholic beverages are often tested during childhood or adolescence. Also, abstainer pupils had often tasted an alcoholic beverage at least once. A significant association ($p \le 0.05$) was recorded between the attitude to drinking alcoholic beverages and the age of the first taste of wine or beer. The first exposure of consumer teenagers was at about 11 and 12 for wine and beer, respectively. The 54.1% of students declaring spirit consumption was asked also to specify the kind of beverage consumed (Figure 1). Among the several beverages the most frequently consumed was vodka (36.6% of preferences), followed by rum (22.7%), cocktails (16.7%) and gin (12.9%).



Figure 1. Different typologies of spirit consumed expressed as percentage (%) of total spirit beverages consumed.

30.8% of the sample declared episodes of binge drinking during the last year with no differences among genders. A significant association ($p \le 0.01$) between binge drinking and the age of the first alcoholic beverage consumption was found. The adolescents were divided into two groups: the students that tasted alcoholic beverages before 14 being defined as "early drinkers" and the ones that tasted alcohol after 14 defined as "late drinkers". Higher percentages of binge drinkers were found among early drinkers (45.4%) with respect to "late drinkers" (15.1%).

The frequency of binge drinking episodes in the last year was 5.1 ± 0.5 with significant differences (p \leq 0.05) between males (6.5 ± 1.2) and females (3.3 ± 0.6). Table 3 shows the mean number of binge drinking episodes between early and late drinkers. No significant differences were found between early and late wine drinkers, while significant differences (p \leq 0.05) were found for beer and spirits. Finally, in addition to binge drinking, the 35.2% of our sample also declared that they mixed more than one alcoholic beverage for a single drinking occasion, with no significant differences among gender. Between them, 50.2% of early drinkers and 16.0% of late drinkers used to mix different alcoholic beverages during the same drinking occasion, respectively. These differences are statistically significant (p \leq 0.05).

Alcoholic beverage	Early drinkers	Late drinkers
Wine	5.1±1.2 ^a	4.8±1.0 ^a
Beer	6.2±0.9ª	2.9±0.7 ^b
Spirits	7.4±1.3ª	3.9±0.8 ^b

Table 3. Episodes (number) of binge drinking in the last years. In line different letters indicate significant differences. Mean values \pm standard deviation.

4. Discussion

In our sample, the percentage of students declaring to be abstainers is 23.3%, data are comparable with the HBSC ones (Health Behaviour in School-aged Children): they reported 21.2% of abstainers in the Lazio region (HBSCb, 2010) and 20.4% in the whole of Italy (HBSCa, 2013). The sample declared that they consumed, typically, alcoholic beverages during the weekend. In addition, a high percentage are used to drinking alcohol far from meals. The habit of consuming alcohol at mealtimes is an important protective factor because in this way approximately 20% of the ingested alcohol is oxidized before it can be absorbed (Paton, 2005; Sadler, 2007). The attitude to drinking alcoholic beverages already from an early age confirms a low adherence to the typical Mediterranean drinking pathway (Cecchini et al., 2015).

The percentage of students who declared drinking wine was 55.1%, 67.1% for beer and 54.1% for spirits, delineating a different drinking pattern with respect to the one recorded from other Italian studies. According to the Italian National Institute for Statistics (ISTAT, 2017) 51.7% of the Italians over 11 years of age drink wine, 47.8% beer and 43.2% spirits. According to the Italian Society for Pediatrics (SIP) (SIP, 2014) 46.0% of Italian adolescents drink wine, 50.4% beer and 23.8% spirits.

Of the 55.1% of the sample that is used to drinking wine, 6.9% declared a daily consumption, 27.6% a frequent consumption and 65.5% a sporadic consumption. According to SIP (2014) the Italian adolescents declared a frequent consumption in 4.2% of the sample and a sporadic one in 41.2%.

Of the 67.1% of the sample that declared drinking beer, 54.3% stated that they consumed it sporadically, 35.2% frequently and 10.5% daily. For SIP (2014) those consuming beer were 14.2%, of which 5.9% frequently and 43.8% sporadically.

In addition, beer is generally consumed in a 330ml mug or in 330 ml cans and the grams of alcohol in a beer with a gradation of 4.5% v/v is about 12g in the standard portion of 330 ml and about 21g in a beer with a gradation of 8% v/v. Therefore, the consumption of beer can easily

exceed the recommendations for the adult population.

In addition, 54.1% of the sample declared a consumption of spirits, giving data that is in disagreement with the ISTAT (2014) data (14.6%). This habit is dangerous at all ages, but especially during the adolescent period. High alcohol content over 30% v/v can cause a faster rise in blood alcohol. The carbonated drink can also increase the rate of absorption (Paton, 2005), with the spirits drunk by adolescents often being rich in carbonate and sugar. The presence of simple sugars accelerates the alcohol metabolism providing a substrate that helps to convert NADH into NAD+ (Cederbaum, 2012). In the sample a high percentage of students (16.7%) reported the consumption of cocktails, often accompanied by large amounts of sugars that also makes the drink more palatable.

Finally, 30.8% of the sample reported binge drinking episodes, 33.8% of boys and 27.6% of girls, in agreement with the HBSC data (HBSCa, 2013): 39% for boys and 24% for girls.

Many studies have documented a relation between first drinking at an early age and alcoholrelated problems in adolescence and adulthood (Meier et al., 2015; Kuntsche et al., 2013; De Wit et al., 2000; Eliasen et al., 2009; Grant et al., 1997). Moreover, in our study the earlier the alcohol consumption the greater the number of binge drinking episodes is, confirming the relation found also in the literature.

The sample showed a peculiar alcoholdrinking pattern characterized by a considerable number of students drinking wine, beer and spirits. It confirms the already alarming national data and shows a worse picture. One reason may be represented by the average age of the sample investigated, which was 15 with respect to 13 of the national one (SIP, 2014) or 11-17 of the Italian sample (ISTAT, 2017). Further analyses are needed to better comprehend the phenomenon and understand the several factors that can interact with it.

5. Conclusions

In conclusion, the Velletri adolescents showed alarming drinking habits, different from

the Mediterranean drinking patterns. Those preliminary results underline the urgent need for prevention plans with the purpose of creating the idea of drinking awareness. An educational program is planned involving institutions, school teachers and researchers. This plan will be addressed to the students in order to explain the problems related to alcohol abuse and to give the instruments to raise awareness with regard to drinking alcohol. The distribution of specific guidelines could also be useful among the young population of Velletri. Moreover, research in Europe and Italy on alcohol consumption should be intensified.

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TEACHINGS FROM THE PAST

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Re-reading *Outline for Field Work in Geography* by Wellington D. Jones and Carl O. Sauer

Davide Papotti^a

^a Dipartimento DUSIC, University of Parma, Parma, Italy

Carl Otwin Sauer (1889-1975) was one of the leading figures in American geography in the first half of the twentieth century. He was born in Montana in December 1889, and got his university degree at Central Wesleyan College in 1908. He also studied in Württemburg and at the University of Chicago, where he obtained his Ph.D. in 1915, with a thesis on the geography of the Ozark highlands (Missouri). In the same year he obtained his first academic appointment at the University of California at Berkeley, where he was appointed dean of the Department of Geography.

We present here a short but poignant article that Sauer wrote, together with his colleague Wellington D. Jones¹, in the *Bulletin of the*

American Geographical Society in 1915, the year of his Ph.D. discussion. This is therefore a work produced in the earliest stage of his career.

In his obituary for Wellington Downing Jones published on the *Geographical Review*, Robert S. Platt states: "Briefer publications reveal more clearly the progress of his geographic theory and ideas. In 1913 as a graduate student he wrote an *Outline for Field Work in Geography (Bulletin of the American Geographical Society*, 47, 1915, pp. 520-525) in collaboration with his fellow student Carl Sauer. This was a pioneer effort observed and recorded by geographers in the field; for years afterward it was used as a comprehensive check list by students engaged in field work" (Platt, 1958, p. 286).

The interest in field work has been a central concern for Sauer's geographical career. In 1924, he published *The Survey Method in Geography*, another essay that is strictly linked to the article we present here. As Dawn Bowen confirms commenting *The Survey Method on Geography*: "This article, in addition to an earlier piece written with Wellington Jones (Jones and Sauer, 1915), laid a foundation for systematic fieldwork". In 1956, in his address as Honorary President of the Association of American Geographers, significantly entitled *The Education of a Geographer*, he emphasized once again the importance of field work: "The principal training of the geographer should

¹ Wellington Downing Jones was born in 1886 in Kansas City, Missouri. He received his S.B. (1908) and Ph.D. (1914) in geography from the University of Chicago, where he was later appointed as a professor. Among his research interests there were the regional geography of India, China, and Japan and geography of agriculture. Among his books one can mention *An Introduction to Economic Geography* (1925) and *Present Status and Future Possibilities of Agricultural Land Utilization in Patagonia* (1932).

come, whenever possible, by doing field work [....] The class of forms, be they of land, vegetation, or culture, is optional; the important thing is to get this awareness of form started up, to recognize kind and variation, position and extent, presence and absence, function and derivation..." (Sauer, 1956, p. 296).

The short text, presented here in its entirety, is conceived, as the very title suggests, as an "outline", a series of notes, regarding one of the central issues in the history of geography and in the history of geographical teaching: the field work.

Reading a text published more than one century ago normally provides the reader with two opportunities: to realize how much has changed in this important stretch of time and, on the other hand, to realize how the research questions have remained the same ones. Rereading today Outline for Field Work in Geography gives, at least from my point of view, a reassuring sense of a continuity, of a substantial coherence. Field work, which has been one of the pillars of geographical research, still represents today an important component for the advancement of research. Even more so in our times, I would say, given the growing work load in terms of teaching hours and bureaucratic engagements that every faculty faces in contemporary academia, the very possibility of going out on field work, in the open air, today seems to represent a precious privilege.

In the century that has passed since Sauer and Jones were writing these lines, the academic work has not been the only thing to change. The increasing virtualization of our experience of the world, the universal diffusion of technological tools as a central form of mediation for our ways of conceiving and experiencing reality, the increased immediate availability of data and, last but not least, the proliferation of simulations of real life experiences on the internet are all elements that contribute to giving a new meaning to field work. The actual experience of being physically somewhere, out there, in the field, assumes both an appealing flavor of a d'antan experience, a precious heritage from the past, and an urgent need. The world "is" out there, still exists in its concrete materiality, and our protected experiences of scholars that spend most of their professional lives in interior spaces risk missing something crucial for geographers: a direct and unmediated contact with the geographical space.

For all these reasons, I think re-reading *Outline for Field Work in Geography* represents a useful exercise, from many different perspectives. First, Sauer and Jones's text provides us with a useful methodological review on preparing field work: the detailed suggestions given by the authors enable us to understand how much preparation must precede the field work as well as how much work follows it.

From a didactic point of view, Outline for Field Work in Geography reminds us that in geographical teaching the experience of field work is invaluable. It represents not only a methodological core, but also a conceptual one: a form of scientific research that is peculiar to a discipline, such as geography, that focuses on the analysis and the understanding of the territory. The text provided by Sauer and Jones is not a theoretical one. However, through a detailed list of "things to do", it suggests to us the complexity and at the same time the importance of field work. Its centrality in geographical research emerges not from highly sophisticated theoretical reasoning, but from immediate evidence: the simple understanding of how many forms of knowledge field work can provide.

Nevertheless, it is inevitable that certain advice can appear dated. Sentences such as "illustrated pamphlets issued by railroads and steamship lines are helpful in many cases" possess a certain flavor from the past (and also a hint of nostalgia, in making us think that once companies transportation invested in а communication that actually conveyed some informative geographical content); on the other hand though they remind us that no source of information is potentially meaningless when trying to understand the complexity of the geographical knowledge of a specific territory.

Some pieces of advice remind us of the variety of choices we have in front of us when deciding how to move around. One of my favorite passages in the *Outline* is the one dedicated to the choice of the most appropriate means of transportation: "The best means of

covering the area should be investigated, whether on foot, horseback, with pack animals, wagon, livery rigs, automobile, bicycle, or boat". Let's not smile at some old-fashioned ways of traveling through a territory. Let us think, on the other hand, of the undeniable fact that each means of transportation brings with it a different perception of the surrounding territory.

Sauer and Jones also remind us about one crucial issue for geographical studies: the amount of time that can be devoted to the exploration of a territory. When they state: "Time should be allowed for reflective observation in the field", they make us aware that, in spite of the increased accessibility to data and information offered by internet and the technological advancements of the last century, knowledge requires time. A precious memento in order to counterbalance the drives to acceleration that threaten research activities in our times, due to a growingly punitive system of measurement of so-called "scientific productivity".

Sometimes the precision of the directions provided by the author can have a touch of obsessiveness. Sentences like "Notes should be taken with a fairly hard pencil. Notes in ink are ruined if they become wet" help us to understand both the necessity to plan even small details, and at the same time the exposure to bad weather that have always characterized field work (even though a section of the *Outline* is devoted to activities listed under the entry "Rainy day work").

The third section of the *Outline* is a precious list of all the possible "layers" of geographical knowledge that can be observed during field work. This array of questions that are at the basis of a careful observation of the territory can also be very useful in a didactic perspective, when planning field work with the students.

As Down Bowen states about Carl O. Sauer: "His rejection of fads and trends, and his commitment to field- and archival-based research, are important factors that seem to have been over-looked as geographers in the 1990s increasingly direct their research to theoretical constructs" (1996, p. 177).

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Outline for Field Work in Geography

Wellington D. Jones and Carl O. Sauer

This outline has been prepared in recognition of the need of defining scope and methods of geographic field work. It is comprehensive enough to be adapted readily to almost any region. Although planned for individual, detailed field research, it also may be helpful in field work of other sorts. Numerous hints on preparations for field work and on field methods are given in order that the inexperienced fieldworker may avoid some of the difficulties which commonly are encountered.

I. PREPARATIONS FOR FIELD WORK

1. Reading the literature on the area

a. Before going into the field, the greatest familiarity possible should be acquired with the available literature, including (1) physiographic studies and their geologic basis, and (2) articles on economic and social conditions.

b. Notes should be made on important points. In notes distinguish between abstracts and quotations. Cite author, title, and page. In some cases such notes should be taken into the field.

c. Study pictures from the area. Illustrated pamphlets issued by railroads and steamship lines are helpful in many cases.

2. Acquisition of maps

a. Those available may include topographic, geologic, soil, hydrographic, vegetation, climatic, and land office.

b. Maps not available for field use may be traced or photographed.

c. Maps intended for much use in the field should be cut in sections and mounted on cloth (paper muslin).

3. Outline of campaign

a. Information of value in shaping field plans may be secured by correspondence with (1) well-informed residents of the area, such as merchants, bankers, county officials, experienced teachers, (2) members of geological, forest, and soil surveys. b. Before going into the field formulation of the purposes of the field work is desirable. Problems which may be encountered and theories to explain them should be outlined as far as possible. An objective attitude toward preconceived theories is necessary for their successful testing in the field.

c. Make note of places to be studied and estimates of time to be spent at each. Revision of such preliminary plans often will be necessary, especially after reconnaissance (see II, 1, a).

d. The best means of covering the area should be investigated, whether on foot, horseback, with pack animals, wagon, livery rigs, automobile, bicycle, or boat. Effective observation, time, and cost are items to be considered in this connection.

II. FIELD METHODS

1. The itinerary

a. If the region is unfamiliar, it usually is best to begin with a rapid trip through the area, to get general relations in mind.

b. At type localities make intensive studies. These are necessary especially

when the major part of the work is reconnaissance.

c. Be sure that all types of areas have been studied before leaving the field.

d. Do not consider it necessary always to cover in a given time all the ground planned.

2. Hints on observation

a. Contrasts and comparisons of parts of the region one with another and with outside regions should be made frequently in the field.

b. Time should be allowed for reflective observation in the field, especially from lookout points, such as hill or mountain tops.

c. Because of the complexity of conditions in most cases, generalizations must be made with extreme care and only after much accurate observation. The geographer needs to guard against emphasizing geographic influences at the expense of non-geographic ones.

3. Getting the view-point of the inhabitants

a. Become one of the people; live with them if possible; take part in their activities.

b. Interview men of authority on local affairs,

such as county officers - judges, assessor, clerk, recorder - prominent farmers, bankers, merchants, grain and stock buyers, and newspaper editors. Discount information from real estate agents.

4. Keeping notes

a. The note-book should be of ample size (not much smaller than 5" x 8", nor too large to be carried in a pocket), should not contain a great many leaves, and should have stiff covers. Loose leaf note-books, the pages of which can be removed and filed, are recommended especially.

b. Note-books and maps should have, in a conspicuous place, owner's name and address and provision for their return if found.

c. Notes should be taken with a fairly hard pencil. Notes in ink are ruined if they become wet.

d. Record date, locality, and brief title with notes. If loose-leaf note-book is used, date each page.

e. Leave a generous margin, and ample space between notes.

f. Take full, systematic notes in the order of their observation. Ordinarily do not attempt to classify notes at the time they are written.

g. Write general impressions rather frequently.

h. Write resumes before leaving one type of area for another.

i. Distinguish carefully in notes between (1) observations, (2) inferences, and (3) information secured from others.

j. Have a page for noting tentative hypotheses and unsolved problems.

k. Supplement notes with sketches, block diagrams, and profiles.

1. Keep a list of addresses of residents of wide local acquaintance and reliable judgment, to whom you may wish later to write for information.

5. Use of maps

a. If practicable use one field map rather than several, recording all data on the one.

b. Indicate precisely on map the localities discussed in notes; plot the itinerary.

c. Some field workers advocate transferring all field mapping to an office map.

6. Rainy day work

a. Write resumes and discussions of topics.

b. Ink in data on maps and make necessary revisions.

c. Gather statistics and other geographic data from local sources, such as court-house records, newspaper files, etc.

7. Collection of views

a. Carry a camera $(31/4" \times 51/2" \text{ or } 31/4" \times 41/4")$. Use much care in composition and exposure; views are of as much importance as notes.

b. Record date, location, exposure, purpose for which view is taken, and direction in which camera is pointed. Indicate on map the places at which photographs are taken. Keep a separate page in the note book for a record of photographs (See IV, 3).

c. From time to time have negatives developed so as to know whether camera is working properly.

d. Gather good views from photographers, railroad traffic managers, manufacturers, etc.

III. FIELD OBSERVATIONS

In the following topics the aim is to stimulate observation from all geographic points of view; as a result, there is some duplication under related headings. Few regions have the wide range of material for which this outline provides, so that in most instances a number of topics will not need to be considered. Nearly all regions have special problems for which provision cannot be made in a general outline. Some of the topics, for example, "weather" and "discovery and settlement," cannot be studied to any great extent in ordinary field work. They should, however, be kept in mind, inasmuch as field observations may furnish useful "leads," which later can be expanded and verified. Field work raises many questions which must be solved, if at all, after leaving the field. Obviously, especial attention should be given to observations which have geographic content.

1. Topography

a. Elevation above sea-level and amount of relief; relation to grade level.

b. Larger features (plain, plateau, or mountain); general relations to each other; relation of region to its surroundings.

c. Character in detail. Upland: area, distribution, direction and angle of slope. Valleys: distribution, size, shape, and trend of main and of tributary valleys, angle of slope of sides and gradient of floors, extent of flood plains, terraces, relation of size of streams to size of valleys. Configuration of the border between upland and lowland.

d. Types of topography, in terms of their origin: influence of rocks and rock-structure, of gradient, of physiographic processes involved in shaping topography, of stage in cycle of erosion, and of previous cycles of erosion. In regional geography physiographic processes and history need be studied only in so far as their understanding makes possible causal descriptions of topography, drainage, and soils, such description giving in most cases the clearest picture.

e. Topographic provinces: bases of differentiation, and character of boundaries.

f. Effects of topography on climate, vegetation, animal life, industries, transportation and people.

2. Drainage

a. Streams and stream systems: number, width, depth and volume of streams; variations in flow, areas flooded, frequency and duration of floods; gradient, erosion and deposition, configuration of channel, changes of channel, nature of bed; origin, age, adjustment or lack of adjustment to rock structure and drainage changes; drainage mesh; area and character of drainage basin.

b. Lakes and ponds: distribution, number, size, depth, relation to streams and underground waters, character of shores; origin, changes in level, area, nature of shore and salinity.

c. Swamps and marshes: extent, distribution, character, relation to stream flow; origin and changes.

d. Underground drainage: relation to number, size, and flow of streams; variations in level of water table; springs (and wells), distribution, size, fluctuations of level and flow, character of water, relation to rock structure; features developed, such as caverns, sinks, and natural bridges.

e. Relation of drainage to climate, vegetation, water power, navigation, land transportation, industrial, municipal and domestic water supply, irrigation, use and reclamation of wet lands, health resorts and recreation grounds, and distribution and character of population.

3. Soils

a. Types: distribution; physical character, origin, mineral composition, texture, humus and water content, depth and nature of subsoil; soil provinces.

b. Relation to native vegetation.

c. Utilization as affected by drought resistance, ease of erosion, rate of exhaustion, "warmth" or "coldness"; kinds and qualities of crops grown; use of soils not suited to agriculture; land values on different soils.

d. Problems of soil conservation: restoration of worn-out soils; checking soil erosion; improvement of defective soils, such as acid, alkali, "gumbo," and "hardpan" lands.

4. Mineral resources

a. Kinds: distribution; structural, physiographic, and climatic conditions affecting distribution, quality, quantity, and accessibility.

b. Development (see III, 12, c).

5. Weather and climate

a. Weather observations: daily range of temperature, absolute maximum and minimum temperatures, length of growing season. likelihood of frosts at beginning and end of sensible, temperatures, growing season; humidity, rate of evaporation; cloudiness and sunshine; dews, mists and fogs; seasonal distribution, frequency, and character of rain, hail, and snow, duration of snow cover; strength and direction of winds, changes in wind directions; storms; frequency of changes in weather; etc. Local Weather Bureau men may furnish valuable data.

b. Inferences concerning climate from the character of the topography, soil drainage, vegetation, and crops.

c. Climatic provinces: bases of determination; width of transition zones.

d. Evidences of change of climate.

6. Coasts and shores

a. Coast lines: horizontal and vertical configuration; headlands, peninsulas, islands, bays, sounds, beaches, bars, spits, marshes, and other features; origin and age of coast line, including changes of level, erosion of headlands and islands, deposition on- and off-shore;

character and origin of harbors.

b. Tides, shore-currents, waves: work of each in modifying coasts.

c. Influence of coastal conditions on shipping, fishing, health and pleasure resorts, distribution of population.

7. Plant life

a. Native vegetation: characteristic species, vegetation associations; aspect, density, luxuriance, and distribution in relation to climate, soil, water table, and topography.

b. Influence on settlement and development of the region; changes in vegetation due to man.

8. Animal life

a. Types of animals, character and distribution with reference to vegetation, climate, topography, and soil.

b. Influence on settlement and development of the region; changes in animal life due to man.

9. Characteristics of the people

a. Physique, health, traits.

b. Social conditions: customs, dress, speech, religion, and political status.

c. Buildings: architecture, materials used, furnishings, condition in which kept.

d. Races: distribution, characteristics; influence of environment, with special reference to different development of different stocks in the same environment, and to survival of traits and institutions acquired in a previous environment (a fundamental geographic problem of great complexity, the interpretation of which requires great care and in many cases cannot be undertaken).

10. Exploration, settlement, and development

a. Explorations: time and character, routes taken, influence on settlement.

b. Settlements: locations and reasons for their choice; nativity of settlers, routes of approach of settlers; occupations and mode of living, means of communication, and political organization.

c. Stages in the development of the region.

11. Distribution of population

a. Density of population and changes of density as affected by geography and other factors.

b. Rural population: distribution; sites and plans of villages and individual farm groups; rate of

growth as compared with that of urban population.

c. Urban population: location, size, growth, and plan of cities; commercial, residential, and industrial districts; distribution of population by race, income, etc.; population density and land values by districts.

d. Immigration and emigration: sources and destinations; reasons for movement, and economic, social, and political effects.

12. Economic activities

a. Agriculture. Types of farming: (1) the growing of field-crops; size, location, and form of farms and of fields; proportion of land tilled; crops, variety, vields. advantages and disadvantages of each crop; husbandry; markets and marketing methods; (2) stock-raising: size and location of farms, proportion of land used for grazing; kinds and quality of animals, size of herds; methods of raising, preparing for market, and shipping; advantages and disadvantages of the region for stock- raising; (3) combination of crop-farming and stock-raising ("mixed farming"); (4) dairying, poultry-raising, gardening, and fruit-growing, as part of the general farm economy, and as independent industries. Values of land, proportion of improved and unimproved land. size and use of wood-lots: type and value of farm improvements, such as outbuildings and fences; influence of type of farming on distribution of population and social conditions; changes in farm practice, introduction of new crops and new types of farming; extension or restriction of producing area.

b. Forest industries: location and size of forests; character of timber, as to species, density, and quality; methods of cutting and logging; character and distribution of lumbering, woodpulp, and wood-working industries; other forest industries, such as turpentining and tan-bark gathering; by-product industries; value of products; transportation and markets; future developments, and possibilities needs of conservation; relation to farming and manufacturing; conditions and characteristics of the workers.

c. Hunting and fishing: products; possibilities of domesticating animals; economic and social influences, especially in the early development of the region. d. Mineral industries: (see III, 4) distribution of mines, pits, quarries, and wells; methods of production, losses, and wastes; availability of power; markets; competing regions; effect on other industries; future of the mineral industries and influence on the future of the region; nature of mining centers, life and characteristics of the miners.

e. Manufactures: distribution as determined by raw materials (local or imported), power, labor, transportation, markets, capital, early start, and individual initiative; size of establishments; growth and changes of industries; relation of manufacturing industries to each other and to other industries at various stages in development of region; relations to competing areas; social conditions and political interests; future of existing and possibilities of new industries.

f. Transportation: trails, roads, rivers, canals, lakes, and railroads; distribution and character of routes as affected by topography, soils and rocks, drainage, climate, vegetation, natural industries, and population; resources, significance in the development of the area; effect of transportation conditions on the and character activities of the people: transportation problems at different periods.

g. Commerce: trade within the region and with outside regions; commodities exchanged, places from which they come and to which they go; methods of transportation; package or bulk freight; trade routes; trade centers, cities, towns, country stores, areas tributary to each, competition between centers, advantages and disadvantages of each center, trade general or specialized; bartering; changes in character of trade in past and probable future changes; influence of trade on distribution and character of population.

h. Recreation and tourist business: types of resorts, attractions, length of season, sources of visitors; accessibility; general influence on localities concerned.

i. Relative importance of different economic activities; degree to which specialization of individual workers has taken place.

13. Geographic provinces

a. Distinguish as geographic provinces regions within which there is essential unity of physical environment and consequently of economic conditions (Dryer). Topography, drainage, climate, vegetation, soils, mineral resources, and position with reference to other regions should be considered in differentiating such provinces.

b. Boundaries: how determined, clear or indistinct (transition zones); relation to political boundaries.

IV. OFFICE WORK AFTER THE FIELD SEASON PRELIMINARY TO WRITING REPORT

1. Transcribing field-notes. The chronological field-notes should be transcribed under topical headings; cross-references in some cases desirable. One of the most convenient methods is the use of loose sheets or cards, which, together with reading notes, can be filed according to topics.

2. The original field-notes and maps should be accessible while report is being written.

3. Numbering and filing of negatives. Negative albums are convenient for the filing of films. (The Eastman negative album is one of the best.) A number should be put on blank margins (not the developed portion) of each negative in water-proof India ink. Title of negative, with date and place, should be written on each negative envelope in pencil.

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