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2016

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How to cite

FERRETTI, Federico. Situated Knowledge and Visual Education: Patrick Geddes and Reclus's Geography (1886–1932). In: Journal of geography, 2016, p. 1–17. doi: 10.1080/00221341.2016.1204347

This publication URL: <https://archive-ouverte.unige.ch/unige:86934>

Publication DOI: [10.1080/00221341.2016.1204347](https://doi.org/10.1080/00221341.2016.1204347)

Situated knowledge and visual education: Patrick Geddes and Reclus's geography (1886-1932)

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Abstract. *This paper addresses Patrick Geddes's relationship with geography and visual education by focusing on his collaboration with the network of the anarchist geographers Elie, Élisée and Paul Reclus. Drawing on empirical archival research in the Geddes's and Reclus's archives in Scotland, France and Switzerland, I contribute to the current debates on geographies of anarchist education and on geography as a visual discipline. From a methodological standpoint, this paper draws on studies addressing historical circulations and localisations of knowledge as constitutive elements of science, trying to answer the Charles Withers' call to study the internal geography of the Edinburgh Outlook Tower, analysing the objects held in this "geographic museum". My main argument is that the collaboration between Geddes and the Recluses inaugurated specific strategies of multi-sensorial geographical education which were not limited to the sight, and which questioned and relativized the unicity of the observer's standpoint through devices like the Hollow Globe. Focusing on apparatuses like the Outlook Tower's geographical exposition and the Valley Section, I show in which ways Geddes engaged with Élisée Reclus's critique of representation, and which contributions this can bring to present-day debates on geographical teaching.*

Keywords: Patrick Geddes, Hollow Globe, Visual Education, Teaching of Geography, Reclus family

INTRODUCTION

Patrick Geddes (1854-1932) is widely acknowledged as a pioneer of regional planning (Chabard 2008a; Meller 1990; Mowson Sullivan 2012; Mumford 1995; Welter, 2002). Some scholars have pointed out and discussed his activities as a geographer and an educator (Mather 1999; Matless 1992 and 2000; Stevenson 1978): my aim is to delve deeper into this last subject, as I argue that there is still some work to be done on this topic. In fact, Geddes,

a polymath who believed in mobilising all scientific disciplines to improve his programme of social reformation, could undoubtedly be defined as a geographer, notably one who worked with both the network of anarchist geographers close to Élisée Reclus (1830-1905) and Pyotr Kropotkin (1842-1921) (Boardman 1944; Ferretti 2012 and 2015a), and the French exponents of the Vidal de la Blache school like Jules Sion (Clout and Stevenson 2004).

Several authors have stated that the Outlook Tower, the geographical museum that Geddes opened at the top of Edinburgh's High Street, was directly inspired by the Great Globe project proposed by Élisée Reclus for the 1900 Paris Universal Exposition (Alavoine Muller 2005; Besse 2003; Dunbar 1974; Geddes 1898). Geddes explicitly presented his enterprise as built in parallel and "in common" with the Great Globe (Geddes 1905b, 552). For that purpose, Geddes maintained close contacts with several members of the Reclus family (Boardman 1944, 129-130; Homobono 2009, 99-100), not only Élisée, but also his elder brother Élie Reclus (1827-1903)¹ and the son of the latter, Paul, who is discussed further on in the present paper. In his seminal work on the relationship between geography and national identity in Scotland, Charles Withers stresses the centrality of the Outlook Tower for Geddes's trajectory, namely in his educational work for promoting geography. Launching an examination of the internal geography of a building transformed into a "temple of geography", Withers argues that, "although others have recognised how the Outlook Tower was central to Geddes's work, little attention has been paid to the geography of the tower itself, to the different spaces it contained, and to the social and intellectual functions they performed in promoting geography" (Withers 2001, 225). According to Withers, "the tower was organised as a set of different but connected geographic spaces, each containing a variety of means – instrumental observations, scale models, walls paintings, floor and wall maps, exhibition of national artefacts – by which Scotland's public could be geographically educated" (Ibid., 227).

A vibrant international literature has recently rediscovered anarchist geographies and their genealogies (Mac Laughlin 2016; Pelletier 2013; Springer, Barker, Brown, Ince, Pickerill 2012; Springer 2013 and 2016) and started to engage with anarchist pedagogies. Considering that the collaboration between Geddes and the anarchist geographers' circuit took place mainly in the field of popular education, this paper contributes first to recent debates on anarchist pedagogies. Simon Springer, Richard White and Marcelo Lopes de Souza argued that, though "education is absolutely central to the production of geographical knowledge, and

particularly in the production of critical geographies” (Springer, White and Souza 2016, 5-6) there is still much work to do in this field. Geddes’s and Reclus’s educational experiments provide early examples of challenging traditional school’s “boredom” (Ibid., 8) and “obedience and authority” (Ibid., 9), through the active involvement of children and adults from popular classes in learning experiences organized out of schools, like the Outlook Tower and the walking model of the Valley Section. The educational work of the Reclus’s and Geddes’s circuits included collaboration with extension schemes and promotion of unconstrained outdoor activities, joining the wider international movement then called “libertarian pedagogy” (Codello 2005; Avrich 2006; Ferretti 2015b). Likewise, present-day literature on anarchist geographies rediscovers the idea of fieldwork as an instrument for both education and social reforms, discussing for instance the anarchistic value of what Ronald Horvath calls the “Expeditionary pedagogy” by William Bunge and other engaged geographers in Detroit and East Lansing in the 1970s. According to Horvath, “that expeditionary practice reflected the anarchist social movements of the late 1960s and 1970s, but that the existent body of anarchist literature was not examined to provide a basis for expeditionary practice” (Horvath 2016, 102), while today “geographical expeditions can be described as a type of unconscious anarchism, meaning the practices were by and large anarchist” (Ibid., 116).

I draw finally on international literature on geographical education and visual practices (Cosgrove 2003 and 2006; Rose 2003) and on the history of geographical teaching in the United Kingdom (Ploszajska 1999; Walford 2001; Sutherland 2009; MacDonald 2011), in order to provide some answers to the question of Gillian Rose about “how, exactly, geography is a visual discipline” (Rose 2003, 213). My main argument is that the collaboration between Geddes and the anarchist geographers inaugurated specific strategies of multi-sensorial geographical education which were not limited to the sight and which questioned and relativized the unicity of the observer’s standpoint through devices like the Hollow Globe, exposed in the Outlook Tower and described below. Analysing the apparatuses of the Outlook Tower’s geographical exposition and of the Valley Section, I show in which ways Geddes engaged with Reclus’s critique of representation, namely of flat maps, discussed by recent literature (Ferretti 2014b). I put this discussion in the context of the aforementioned Geddes’s pedagogical commitment in order to better understand these (visual or not) geographical devices because, as Rose pointed out, “work on visual culture argues that the particular

audiences (that might not always be the appropriate word) of an image will bring their own interpretations to bear on its meaning and effect” (Rose 2007, 11).

This paper draws on primary sources I was able to consult in the Geddes’s, Reclus’s and Kropotkin’s archives in Glasgow, Edinburgh, Paris, Geneva and Moscow. From a methodological standpoint, I address these sources in the theoretical framework of studies analysing the international spread of ideas amongst scholars in geography (Robic 2013) and problematizing the historical circulation and localisation of knowledge as constitutive elements of science (Livingstone 2003; Livingstone and Withers 2011). Thus, this paper also deepens the knowledge of Geddes’s international networks, and especially what has been called his “French connection” (Fowle and Thomson 2004).

In the first part of the paper, acting on Withers’s observation above, I analyse the material layout of the Outlook Tower and the geographical objects it contained in relation to Geddes’s political networks. I focus especially on the model of the Hollow Globe he built in collaboration with Élisée and Paul Reclus in order to better understand its working as a spatial and visual educational dispositive involving, as I will show, an early definition of the idea of situated subject. Then, I analyse the relief of Edinburgh by Paul Reclus and the other geographical objects exposed in the Outlook Tower in order to highlight their links with the Reclus’s project of the Great Globe (1900) and his idea of a dialectic relationship between local and global culture. Finally, I address the links between these objects and the Reclus-inspired model of the Valley Section in order to understand its significance for both visual education and anarchist approaches to the teaching of geography.

THE OUTLOOK TOWER

Geddes’s anarchist networks

One can appreciate Geddes’s interest in geography at a time when it was not yet institutionalised as an academic discipline. According to Withers, the first chairs in geography at Scottish universities were only created in the twentieth century, whereas “in Scotland, public audiences for geography and for geographical knowledge existed before the institutionalisation of the subject in universities and in dedicated civic societies” (Withers, 2001, 234). From a practical standpoint, I would argue that Geddes’s geography was based first on its capacity to interest a diverse audience, aiming to reach a vast and popular public of both young students and adults, and organised on the basis of non-institutional networks. A cooperative allowed Geddes and his colleagues to buy the Outlook Tower and start their

famous work of urban renewal in High Street (Élie and Élisée Reclus 1894). This is the first point in common between Geddes's local networks and the international networks formed by anarchist geographers, who, hardly occupying university posts, depended for their material survival on their activities as writers and speakers (Ferretti 2014a). I would argue that the similar organisation of the knowledge produced by Élisée Reclus and Geddes in the respective networks was one of the main effects of places and material conditions in their work; if Reclus and Kropotkin worked outside of the universities, thus producing knowledge in extra-institutional places, Geddes, in his Edinburgh enterprises, developed a similar militant approach, proposing a geography which aimed to the education of all the people. Thus, they shared similar methods, aims, and places – like the Outlook Tower – to communicate directly with young people and popular classes.

Geddes, although indeed a university teacher, was appointed to a post in biology in Dundee and never managed to occupy a chair of geography in Edinburgh (Meller 1990). It is worth noting that one of his anarchist friends, Kropotkin, was directly engaged in a dialogue between geography and biology in the context of Darwin's evolutionism (Dugatkin 2011; Girón Sierra 2003; Kinna 2016), which was then acquiring predominance in the British scientific world (Secord 2014). In the evolutionist debate, Kropotkin was the strongest supporter of the theory of mutual aid (Kropotkin 1902), arguing that cooperation was one of the most important principles of both biological and social evolution and challenging the "Social Darwinists", who stated that the "strongest law" was the legitimate evolutionary principle. The theory of mutual aid was elaborated collectively by Reclus, Metchnikoff and Kropotkin in Switzerland (Ferretti 2011) and, according to Helen Meller, Geddes "strongly sympathised for the ideas of the Russian émigré ... who argued that even in natural evolution there are proofs of cooperation among species for their own support and natural development" (Meller 1990, 39). A political refugee in Great Britain, Kropotkin visited Edinburgh in 1886 and made known to Reclus the urban renewal work Geddes was undertaking there. Newly available correspondence from Kropotkin's archives in Moscow shows better the acquaintance between Geddes and the Russian exile. In 1887 Anna Geddes, Patrick's wife, introduced their new projects to Kropotkin, such as the new University Hall and its related initiatives for the education of "the working people of the neighbourhood, [hoping] the students themselves will learn something from living amongst them".² These materials also show that Patrick Geddes discussed the theory of mutual aid with Kropotkin, endorsing the Russian geographer in his debates with Thomas Huxley (1825-1895) on the "survival of the

fittest”: “Still I have many improvements on Darwin ... Huxley does not do better: a little socialism would have been the saving of him!”.³

By way of Kropotkin, contacts were established and the brothers Élie and Élisée Reclus attended the Edinburgh Summer Meetings in 1893 and 1895 (Meller 1990, 104), of which the Outlook Tower was considered as a continuation. Geddes also viewed his “geographical museum” as an extension of the Summer Meetings, stating that, in 1898, they were “now permanent in the Outlook Tower” (Geddes 1898, 531). Before trying to reconstruct a visit to the Outlook Tower, we must first meet one Georges Guyou, the pseudonym adopted by Paul Reclus (1858-1941) in 1894 when he sought refuge in Scotland. He was sheltered there by Geddes (Dunbar and Rapacka 1995) in his flight from the French police, who believed that he was involved in the dynamite attacks carried out that year by the so-called “anarchist-individualists” (Bantman 2013; Maitron 1964). Trained in Zurich as an engineer, Paul, the future biographer of his famous father, Élie, and uncle, Élisée (Paul Reclus 1966), was very close to the latter. A letter he received from his uncle while he was in Edinburgh displays the sense of irony these scientists and militants possessed: Élisée Reclus (who signed with the pseudonym Jacob Jacobsen) wrote quite tickled to Guyou that the police were looking for him between Brussels and Anvers.⁴ According to Siân Reynolds, Paul Reclus was “one of Geddes’s right-hand men at the Outlook Tower” (Reynolds 2004, 75), where his contribution, according to Pierre Chabard, “was a capital one” (Chabard 2008a, 207). The two men enjoyed a lifelong friendship which also included their respective families (Clout and Sullivan 2009). In any case, sheltering an anarchist who was wanted by the police is a fact that makes plain Geddes’s political sympathies at the time.

The Hollow Globe: knowledge as a (multisensory) point of view

Recent literature stresses the multisensory value of the Outlook Tower, whose visit implied a strong visual experience, but involved also other sensory gates. According to Fraser MacDonald, the dispositive displayed by Geddes in the Tower “captured his particular way of doing geography, whereby a proper synthesis and analysis could be obtained only through disciplined forms of looking and feeling” (MacDonald 2011, 270), as it brought the observer “from daylight to darkness and back again” (Ibid., 271). If a hole in the *Camera Obscura* allowed to see “a synthesis of landscape” (Ibid., 273), the presence, in the whole exposition, of three-dimensional objects which could be manipulated provided a fundamental integration: as MacDonald posits, “touch was in fact another form of sight” (Ibid., 275). The author

concludes that, “about the relationship between visibility and geographical knowledge we must reach beyond the rhetoric of the visual to attend to the multisensory business of looking” (Ibid., 278), linking this to Geddes’s concern with his own personal experience of a temporary blindness.

In the same vein, Teresa Ploszajska draws on the multisensory value of the spreading of geographical models like the raised-reliefs, already used in the United Kingdom by the end of the 19th century and then widespread in the inter-war period. According to Ploszajska, “picture study became regarded as an excellent substitute for personal observation of faraway places through travel” (Ploszajska 1999, 137), and this concept was soon extended to three-dimensional models: “The study of visual images was an integral component of school geography lessons. Geographers and educationalists were broadly agreed that appeal to the eye was among the most effective means of capture pupils’ interest in the subject and conveying geographical ideas with clarity” (Ibid., 178). Thus, the construction of geographical models “appealed to senses other than sight alone” (Ibid., 180) as they could be both “handled and observed” (Ibid., 182). In the same period, according to Rex Walford, “a significant field-work component in British geographical education” (Walford 2001, 105) progressively arose, not without a Geddes’ contribution. Geddes and the Recluses were thus inserted in this movement, and their original contribution, as I argue in the last part of this paper, was their focus on a civic engagement aiming to build “emancipation through knowledge”, inserted in the wider international movement of popular universities, modern schools and workers’ schools (Avrich 2006; Codello 2005; Ferretti 2015). Today, the idea of unschooling as discussed by Simon Springer draws directly on this tradition, rediscovering field experiences and alternative pedagogies taking place outside of institutional contexts (Springer, 2016b).

If we take seriously Withers’ call to analyse the internal geography of the Outlook Tower (Fig. 1), the main source where we should begin is the pamphlet published by Geddes in 1906 to describe the Tower’s displays. The museum was organised on four floors corresponding to different (but correlated) scale levels: Edinburgh, Scotland, Europe, the World, and another that is devoted to “language”. This approach has led critics today to define Geddes as a forerunner of the slogan “act local think global” (Stephen *et al.* 2007), because the Scottish geographer argued that it was impossible to study cities’ local dimension without “helping people to have an idea of its relations with the rest of the planet” (Geddes 1906, 5).

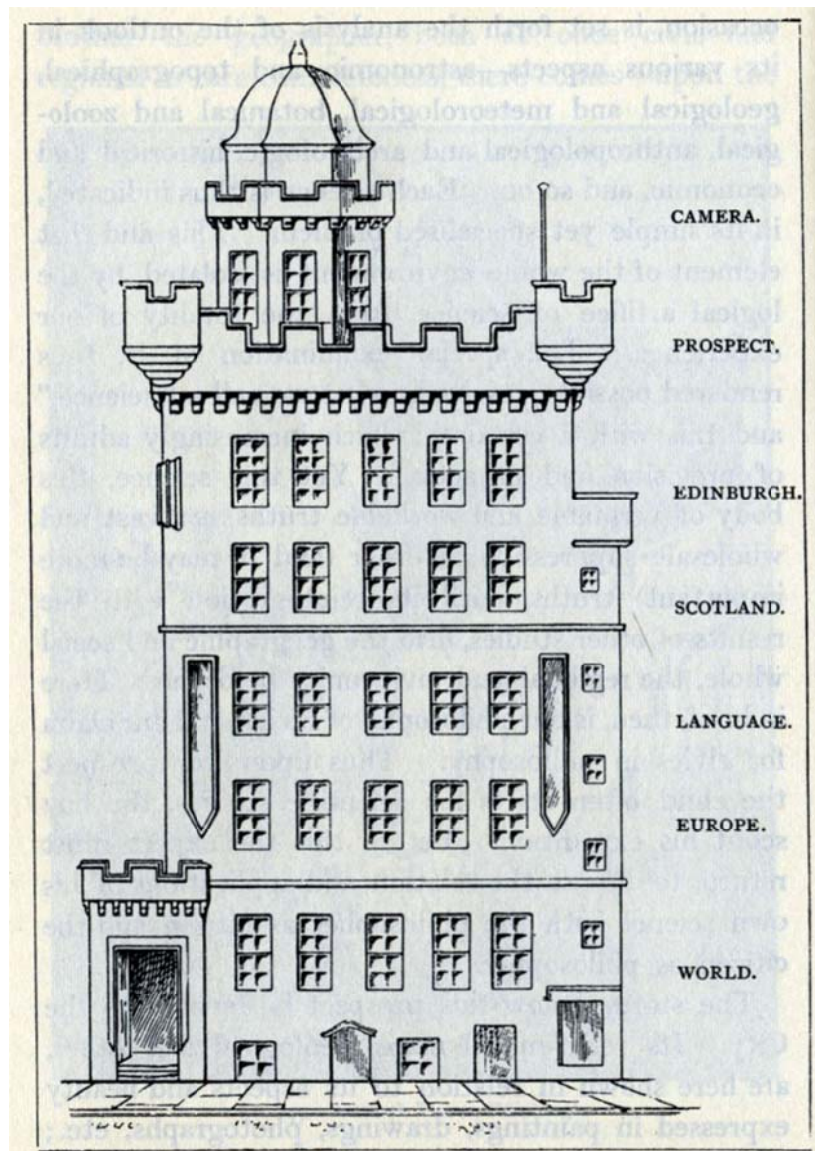


Fig. 1 – The Outlook Tower (Geddes 1915, 371)

This approach stands at the origins of what is called today, in the field of primary education, the expanding environments model. According to Jere Brophy and Janet Alleman, in twentieth-century North-American educational systems, “the expanding communities sequence became the dominant structure and framework. Also known as the expanding horizons or expanding environments sequence, it begins with a focus on the self in kindergarten and then expands the purview to the family and school in first grade, the neighborhood in second grade, the community in thir grade, the state and region in fourth grade, the nation in fifth grade, and the hemisphere or world in sixth grade” (Brophy and Alleman 2009, 358). Albeit this model has been subject to various critiques, Brophy and Alleman contend that teaching by focusing on local contexts and on concrete examples in

order to explain universal concepts is still a good strategy for both geography and citizenship, recalling Geddes's and Reclus's educational ideas. "An approach that begins with what is familiar to the students in their immediate environments and then moves to the past, to other cultures, and to consideration of the future constitutes a better rounded and more powerful social education than an exclusive focus on the past that is inherently limited in its applicability to today's students' lives" (Ibid., 363).

After the panorama from the Outlook Tower, the visit continued in the little octagonal turret on one side of the roof, where viewers could start to appreciate Paul Reclus's work with his "invention of the Episcopo" (Chabard 2008a, 232). This device aimed to show a cartographic representation of the world not through the traditional zenith perspective, but as it was seen from an observation point situated on the terrestrial surface (in this case Edinburgh) if Earth were transparent (Chabard, 2008b). This was for "Arousing both the everyday observer from his indifference, and the geographer from his attachment to the map or even the ordinary globe, by compelling both to visualise the world as if it were suddenly to become transparent beneath one's feet ... Thus the forms of the continents and countries so familiar to us upon the map or globe seem now distorted into the strangest forms, while these are rendered doubly hard to understand by the fact that we are here seeing them not as usually represented, from their surface, but with their outlines completely reversed ... This strangest looking of world-maps is the most real and immediate sense possible, that of the personal one, the observer here" (Geddes 1906, 13).

The same room contained a portable version of the Episcopo called the Hollow Globe, an object built by Paul Reclus and described in a short brochure that is reproduced here (see Appendix). This work is clearly consistent with Élisée Reclus's critique of two-dimensional maps, which accompanied the construction of three-dimensional objects like raised-reliefs and "spherical maps" that were developed along with the Reclus's Grand Globe project for the 1900 Universal Exposition in Paris (Ferretti 2014b). Around the same time Élisée Reclus was giving lectures at the major European geographical societies, including the London Royal Geographical Society, to promote the educational use of his Spherical Maps, curved aluminium sheets which aimed to "exactly" reproduce the earth's curvature, with a map drawn and coloured accordingly on the surface; in London, the anarchist geographer argued that flat maps should be forbidden in primary education, because they instilled "false ideas" (Reclus 1903, 291). He had already stated that "the globe outdoes the map by nature of its truthfulness" (Reclus 1895, 3). At the same time, the Geographical Institute of Brussels'

Université Nouvelle, directed by Reclus, produced little cardboard educational globes for the Barcelona Modern School, which was run by the anarchist educator Francisco Ferrer y Guardia (1859-1909).⁵

The Hollow Globe (Fig. 2), part of the same trend, was called a “tool for teachers” and was meant to resolve not only the defaults of flat maps, but also those of “ordinary globes”: “The great drawback in the use of an ordinary globe is that only a small part of it can be seen at one time, and thus it is difficult to grasp the relations of two places which are some distance apart. Further, with an ordinary globe, the pupil must always regard the world from a point outside, whereas more stress should be laid on the world as seen from a point on its surface” (P. Reclus 1902, 2). The device looked like a conical glass funnel, and on its inner surface Guyou had drawn a representation of the world, deformed as it would be seen by a viewer located in Edinburgh according to a central projection. It was accompanied by a “normal” globe, which could be placed inside the cone to orient it and put the point representing Edinburgh in correspondence with the central point of the projection, where the observer’s eye is located. The same exercise could be repeated from any other point on the terrestrial surface, building a new funnel and developing the projection from the newly chosen point. The Hollow Globe was enthusiastically described by Philip Boardman: “[it] allows one to visualise the world as if it had suddenly become transparent under his feet. Looking into a round glass case at a strangely distorted map, we behold the earth in the perspective it would have from this tower: continents and oceans seemingly turned inside out and backwards, Scandinavia a large imposing mass while Australia is shrivelled up to a tiny spot, and similarly for other lands far and near. What a fertile challenge to minds accustomed only to conventional flat maps and to globes!” (Boardman 1944, 184).

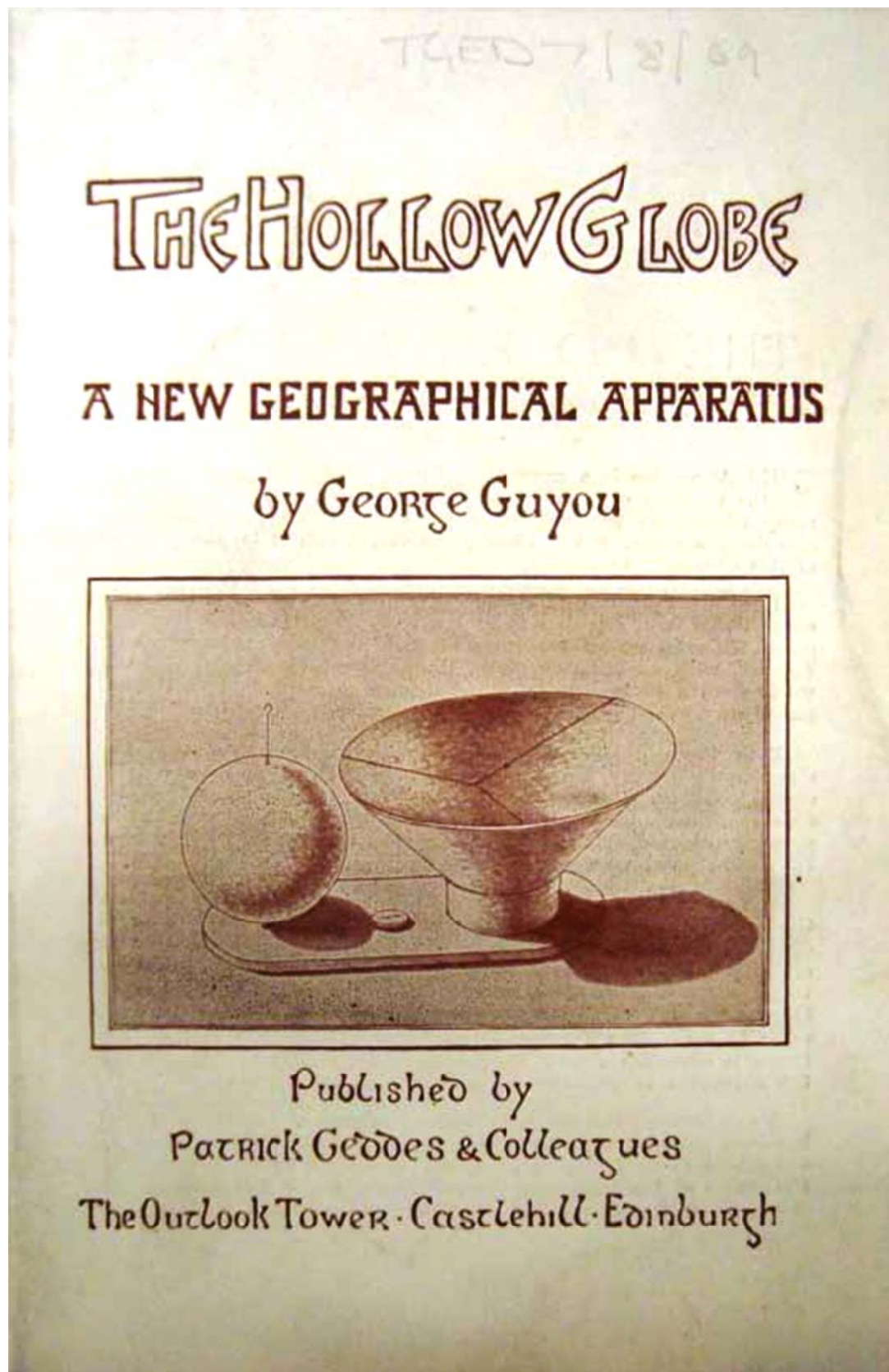


Fig. 2 - G. Guyou [Paul Reclus], *The Hollow Globe*, 1902.

As no original copies of this device have survived to our knowledge at present, and no geometric or mathematic information is provided on the process of reducing and distorting the world's map, it is difficult today to judge these objects *per se*. Nevertheless, I would argue that the Hollow Globe posits very important issues on the nature of geographical knowledge. First, it questions and problematizes the viewer's standpoint, making one give up assuming the perspective of God, called "Apollo's Eye" (Cosgrove 2003), or even "the god-trick of seeing everything from nowhere" (Haraway 1988, 581), to situate oneself as a concrete observer. If we consider that the device was designed to be used in primary education, we could argue that Guyou's and Geddes's aim was to familiarise visitors (children and adults) with the principle of the relativity and multiplicity of standpoints and, by extension, cultures, and therefore to invite them to situate themselves with respect to the rest of the world. Second, from a cartographic standpoint, it seems to be a very clever and original instrument for the time to show the relative nature of the various possible projections and thus to make one wary of the intrinsic claims of the truthfulness of graphic and cartographic devices. Through the Hollow Globe, Guyou and Geddes deconstruct projections as an artificial process by revealing their nature as deliberate choice. They also introduce the concept of geodesic *Datum*, showing the point on which the terrestrial sphere is conventionally placed on a different surface to develop its projection (Gomarasca 2009). Finally, from a philosophical standpoint, the Hollow Globe anticipated current questionings of the classical idea that the basis of modern knowledge is the separation between subject and object, where the former is necessarily outside the latter (Farinelli 2003): the Hollow Globe shows a world where "imagination is helped to expand this picture until it embraces the whole world as he would see it if the sphere were of glass" (Paul Reclus 1902, 2).

Globes, reliefs and situated educational views from the Outlook Tower

The visit continued descending the Tower. In the Edinburgh Room another device connecting the local and the global was on display, namely the raised-relief of the city of Edinburgh. This 1:4,000-scale raised-relief was built by Paul Reclus and presented as the only existing model that represented vertical features true to scale, that is, without exaggerating any of the heights (Geddes 1906, 17). This was exactly the program of the Grand Globe, whose project envisaged a uniform scale of 1:100,000 for all three dimensions, a central point for Charles Perron (1837-1909), Swiss anarchist and Reclus's cartographer, who prescribed precise rules, insisting that "in a raised-relief, nothing should be represented which is not at

the same scale” (Perron 1900, 1). It is worth noting that Perron’s masterpiece, the *Relief of Switzerland* (1900) was a part of the Great Globe, and conceived together with the whole project (Ferretti 2014b). According to an 1899 Élisée Reclus’s letter to Anna Geddes,⁶ and to his correspondence with Perron that is conserved in the Geneva Public Library, another fragment of the projected Great Globe ought to have been the relief of Scotland, to be built starting with “the little fragment Edinburgh-Glasgow”⁷. The relief’s creator was once again Paul Reclus, as Kropotkin wrote to John Scott Keltie, prudently employing the name of Guyou.⁸ While the relief displayed in the Outlook Tower is more recent and could not be considered a fragment of the Grand Globe, strictly speaking, because it was done at a scale of 1:4,000, it is clearly part of the same way of thinking.



Fig. 3 - Edinburgh, University Library, Center of Research Collections, A8. 1 Caption for plaster model of Edinburgh district by Paul Reclus.

The raised-relief (Fig. 3) represented “what is now generally recognized as the needful approach to any scientific and practical study of geography, the literally solid knowledge of the facts of relief” (Geddes 1906, 18), and drew on the idea that “local knowledge was a manner to understand global questions, and vice versa” (Withers 2001, 232). Presented at the 1911 Scottish National Exposition, it played a role in the geographical construction of the Scottish nation, conceived all the same within a framework that was cosmopolitan rather than

chauvinistic. Geddes clearly laid claim to a Scottish and Celtic identity (Meller 1990, 63), and his most original initiative for the cultural construction of his nation was the proposal of a National Institute of Geography, which remained unrealised in the end. In a 1902 issue of the *Scottish Geographical Magazine*, Geddes presented a draft project of the Institute as “prepared after consultation with the great geographer Élisée Reclus while its present architectural form is due to the pencil of M. Galeron” (Bartholomew 1902, 147). The outlook that is embraced is clearly neither a chauvinist nor a limited nationalist one since the main objects that were to occupy the ground floor were actually two symbols of universality and internationalism, namely two globes: the Celestial Globe by Galeron and a terrestrial relief globe by Reclus, smaller than the 1900 Paris project “to unite and harmonise many lines of geographical activity and educational endeavour” (Geddes 1902, 142). Similar symbols of universality could be found in the Outlook Tower. After the Scotland Room, for instance, visitors encountered a Botanic Globe (1:10,000,000 scale), which was “built in Brussels under the direction of the late Élisée Reclus, coloured to represent the characteristic vegetation of the globe’s different regions, as well as the hot and cold ocean streams which partially determine climate, and thus vegetation” (Geddes 1906, 20). It is worth noting here that anarchism and nationalism were not necessarily in contradiction then, as early anarchists endorsed the struggles for national liberation in Eastern Europe and readily recognised historical facts like the Italian *Risorgimento* and the Spanish *Sexénio Democrático*, hoping that national revolutions might spark social ones (Ferretti 2014a). At the time, anarchists were in solidarity with national struggles in the colonised world (Anderson 2007). According to Ruth Kinna, ideas on anti-colonialism and territorial autonomy contribute to explain Kropotkin’s controversial choice to support French and British democracies against the Central Empires during the First World War (Kinna 2016). I don’t have the space here to delve deeper into this subject, but it is worth noting that Reclus’s Grand Globe was exactly an attempt to represent an idea of universal brotherhood considering at the same time cultural differences, one which is now studied by a vibrant international literature addressing postcolonial anarchism and its relations with indigenous traditions (Hirsch and Van Der Walt 2010).

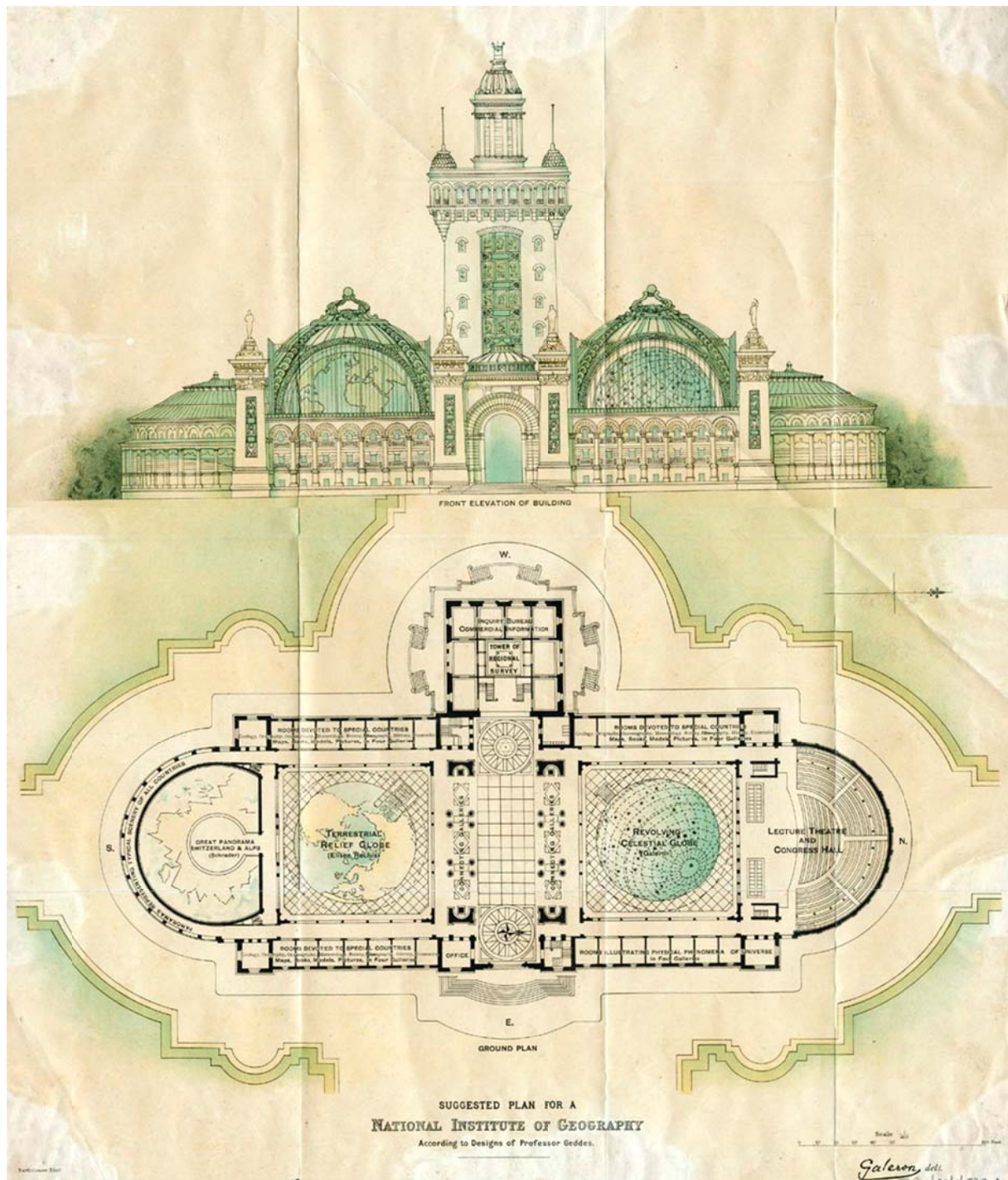


Fig. 4. A. Galerón, P. Geddes, “Suggested Plan for a National Institute of Geography”, *Scottish Geographical Magazine*, n. 18, 1902.

At the end of the tour in the building’s entrance, a hall occupied by a geographical library containing travel books and atlases, visitors came upon the last object made in Brussels under Élisée Reclus’s direction: a 1:10,000,000-scale globe, “coloured to denote merely the most general physic features, the division of land and water, and the contours, heights and depths of these. If it be taken as representing the size of the earth, a ball 12½ inches in diameter at the

NE corner of the Tolbooth Church opposite would indicate the relative distance from the earth of the moon, while the Dalmahoy Hill, some ten miles away, would roughly represent the relative size and distance from the earth of the sun” (Geddes 1906, 31). As Wouter Van Acker has observed, Geddes’s internationalism was to influence in subsequent years his Belgian correspondent Paul Otlet (1868-1944), a fellow of the *Université Nouvelle* where Reclus had taught, and founder of the “International Palace”, or *Mundaneum*, another avatar of the Grand Globe (Chabard 2008a; Van Acker 2011).

In 1905, Élisée Reclus sent a letter to a meeting of the Outlook Tower Committee, containing a full endorsement of Geddes’s work. “The Outlook Tower is an important educational museum which addresses itself to the man as a whole, which tries to watch in him the thoughtful, the educational and the observing institute alive and then to enlarge his synergetic value. In the future there will be plenty of these institutions, no doubt better equipped than the Outlook Tower, but none in such an exceptional situation, between sea and volcano, busy Princess Street and lonely Pentlands ... and High Street, for ever puzzles to the wondering man. May the workers fill the Outlook Tower with a new *ardeur*”⁹. Élisée Reclus died in this same year, but the collaboration between Paul Reclus and Geddes would continue until the death of the latter in 1932. In 1913, Geddes asked Reclus/Guyou to construct another Hollow Globe, a product that was still in demand.¹⁰ The last phase of the scholars’ collaboration was a project to open a new Outlook Tower in Domme, in the French region of Périgord, close to the region that was the Reclus family’s ancestral home. The tower was finally inaugurated in 1937 by Paul Reclus as the *Musée du Périgord noir* (Chabard 2004 and 2005). What was at stake with the existence of such a museum was examined and debated for several years by Paul Reclus and Geddes, who wrote in 1931 to his French friend, laying out the ambitious program that he had to realise and stating the need for an educational museum in every city and village for social cohesion and public betterment. He seems to be influenced still by anarchism in his assertion that school was the proper substitute for the Church on the path of progress, recalling the French debate on *éducation laïque*. “Just as a medieval village built its church or a modern one has a school, so this is needed anywhere, in every village anew. A real step in its Civilisation-resources! Association with school is often possible, even with School Garden between”¹¹.

THE VALLEY SECTION, SIGHT AND OTHER SENSES: HOW GEOGRAPHY OUGHT TO BE TAUGHT

As previously mentioned, all these devices had first an educational purpose. This was also the main task of the Valley Section, used by Geddes as a model for geographical teaching, namely to offer a direct approach to the world in primary education, beginning with excursions, which according to Geddes and the anarchist geographers had to precede manuals and maps. This idea was first applied by Heinrich Pestalozzi at the Yverdon School and enthusiastically endorsed by Carl Ritter, and subsequently Reclus and Kropotkin (Ferretti 2013). Anarchist geographers made it a central point in their critique of traditional teaching that was done through maps, manuals and mnemonic repetition of names and numbers (Kropotkin 1885). The movement of “libertarian pedagogy” was widely founded on the tradition of Pestalozzi and Fröbel, drawing on the use of models and sensorial methods for education, as well as on the valorisation of the pupils’ direct experience. According to T. Ploszajska, these ideas were equally influential in the tradition of geographical teaching in British schools: “like fieldwork, with which it was closely associated both in principle and practice, modelling made children active participants in the acquisition of geographical knowledge” (Ploszajska 1999, 182). The circulation of these ideas was carried on through different, sometimes rather subterranean, ways: “time and again, proponents of constructive handwork quoted Rousseau or adopted his reason without acknowledgment” (Ibid., 195).

The main originality of the anarchist geographers, in this movement, is that they did not aim to found an “imperial citizenship” as the one exposed by Ploszajska: their main preoccupation was to stimulate the free development of children’s personalities through pedagogical activism and the practice of geography in open air (Ferretti 2015b). The importance they gave to the involvement of more senses is witnessed by the Reclus’ correspondences on the construction of his globes and reliefs, stressing the necessity that they can be safely manipulated by children.¹² Geddes’s sympathies for anarchism, at least in the years in which he frequented the Reclus family, came with an explicit declaration through the Outlook Tower exposition: “Above the cap of Liberty, we find the red flag of Socialism, the black flag of Anarchist, symbolising contrasted tendencies which we have in our midst even now; and, corresponding to these, the symbol of the enormous increase of wealth, yet also of empty hands” (Geddes 1906, 28-29).

Geddes’s commitment to pedagogy was intense, starting with his concern for the British movement known as University Extension, inspired by the tradition of humanitarian socialism. “University extension in Scotland was modelled on the English system that since 1873 had been sending out university lecturers to provincial towns across England to provide

higher education to those previously excluded from it by class, gender or physical distance” (Sutherland 2009, 357). Geddes’s aim was to overstep the paternalistic limits of that initiative, making University Extension the centre of a movement which stimulated in the lower classes a critical consciousness and a consequent civic engagement. In this vein, the Edinburgh *Summer Schools* experiment began in 1885, the main objectives of which were “the synthesis of human knowledge and the promotion of a holistic, interactive and distinctly non-competitive approach to education” (Ibid., 362). Around the same time, John Scott Keltie (1840-1927) published his report on *Geographical Education* (1885), following a debate that involved geographers of very different political ideas like Kropotkin and Halford Mackinder (Kearns 2004 and 2009). As Withers points out, if the report had been “principally considered in relation to England, its impact was no less in Scotland” (Withers 2001, 207). Geddes’s idea of the Outlook Tower as a geographical and educational point of view on the region is part of the same approach to education promoted by Kropotkin, Keltie and others; the wide panorama that the upper terrace afforded was thus presented as the indispensable introduction to the geographical exposition installed inside. On the upper roof, visitors received point of view on “the art of seeing (because) it is growingly recognized that it is necessary to supplement our present bookish education by training people to observe a first hand, and to make use of their observation for themselves” (Geddes 1906, 10).

In his paper entitled “Nature Study and Geographical Education” (1902), Geddes analysed the educative potential of making children progressively discover their surroundings, for instance by walking along a river to understand through concrete experience the concept of valleys, introducing his concept of Valley Section; this method takes advantage of pupils’ wonder vis-à-vis nature, which anticipates rational understanding. The authors quoted by Geddes include an art critic, John Ruskin, and a geographer, Alexander von Humboldt, who both stressed the importance of the aesthetic impression as the phase preceding rational knowledge. In the case of Humboldt, the step from aesthetic feeling to scientific understanding is considered a fundamental point in his idea of landscape not as an object, but as an instrument of knowledge, a model of perception and comprehension of the terrestrial surface (Minca 2007). Thus, Geddes endorsed the “teaching of beauty” inspired by nature. Indeed, as he saw it, the study of nature and the study of art share the same bases and the same aims, in this case building a different world in the struggle against what Geddes called “modern ugliness”, a definition that brings to mind his own critique of the industrial city of that time (Mumford, 1961). “The pedagogue will not agree that here is also the beginning of

art-appreciation, however long before art production? ...Here there is a main strategic point in the warfare against modern ugliness; one also which reflection will show throws much light on the general failure of that commonplace art-teaching which has been a staple of our schools for fifty years. With this fundamental craving for beauty all the senses are at work; hence the child's desire of seeing and hearing, touching and handling, of smelling, and tasting are all true and healthy hungers, calling for the generous ministry of nature to the growing brain through each and all these sensory gates" (Geddes 1902b, 530). According to Geddes, some adults are negatively conditioned by an education which frustrated their curiosity and abilities: "Too many adults are thus not developed children, but defective, stunted, or degenerate ones: it is not too much to say that much of the so-called 'education' of the past is literally definable as the production of artificial defectives" (Ibid.).

The geographical issues raised by the Valley Section have already been extensively analysed in the literature (Boardman 1978; Meller 1990; Pousin 2012). Several authors state that Reclus's models were fundamental in the elaboration of Geddes's Valley Section, which was indeed inspired by Reclus's idea of the hydrographic basin, which he set out in his *Histoire d'un Ruisseau* (Dunbar 1978; Ferretti 2012; Raffestin 2007). The sources consulted for the present research reinforce the above assertion, suggesting further links, especially the continuity between the reliefs projected for the Great Globe and the idea of cross-section of the hydrographical basin: in the aforementioned letter to Anna Geddes, Élisée Reclus offered some suggestions to his correspondents on the region to use as an initial model for the raised-relief map of Scotland that his nephew Paul was preparing. "If the budget of the geographical museum [the Outlook Tower] does not allow one to make the raised-relief proportional to all of Southern Scotland, the most important fragment of this region, the isthmus strictly speaking, between Forth and Clyde, would already offer the most attractive and instructive of pictures"¹³. If we consider a cross section of this ideal model, we obtain the Valley Section, an idea that Geddes presented for the first time in 1905 (Geddes 1905a). Denis Cosgrove considered the Valley Section as a way of seeing landscape which contributed to define the modern concept of community, an "original synthesis of territorial and pictorial" (Cosgrove 2006, 33) which expressed both the Alexander von Humboldt's idea of *Zusammenhang* (interconnection of physical and cultural features) and the Romantic approach giving images a specific value for education and social change, drawing on "Ruskin writings, [where] the picturesque retained a powerful moral engagement" (Ibid., 34). According to several authors, the idea of the Valley Section was inspired not only by Reclus, but also by the Sociological

Survey of Frédéric Le Play (Robic 1995; Meller 1990); nevertheless, it is important to bear in mind that its material realisation was constantly followed and supported by the Reclus family, starting with the common project for the raised-relief of Scotland as part of the Grand Globe.

In the subsequent years, Geddes prepared drawings and schemas for the Valley Section, then presented in the American journal *Survey* (Geddes 1925), while Paul Reclus was asked to elaborate the first graphic models. A 1913 letter by the latter evinces an on-going dialogue which was technical as well as intellectual. Paul Reclus was less known as a geographer than his famous relatives Élie and Élisée, but what Geddes asked of this younger Reclus was not technical competence but rather true scientific expertise for the Valley Section. With the help of Geddes's son Alasdair, who was then in Brussels, Paul Reclus was searching for examples of rivers and towns that met the criteria of Geddes's project and could assume the character of a universal model of the river valley. One of the problems they encountered was the scarcity of geographic case studies corresponding to the theoretic model, which represented the parallel descent of the river and its valley to the port town. "My difficulty is that among the well-known rivers of Europe, there is no one which answers really to the diagram: Elbe, Rhine, Rhône, and Danube are traversing intermediate mountains; Vistula, Oder, and Seine hardly come from mountains. Loire and Garonne would answer best, but the towns on their banks are not always characteristic" ¹⁴.

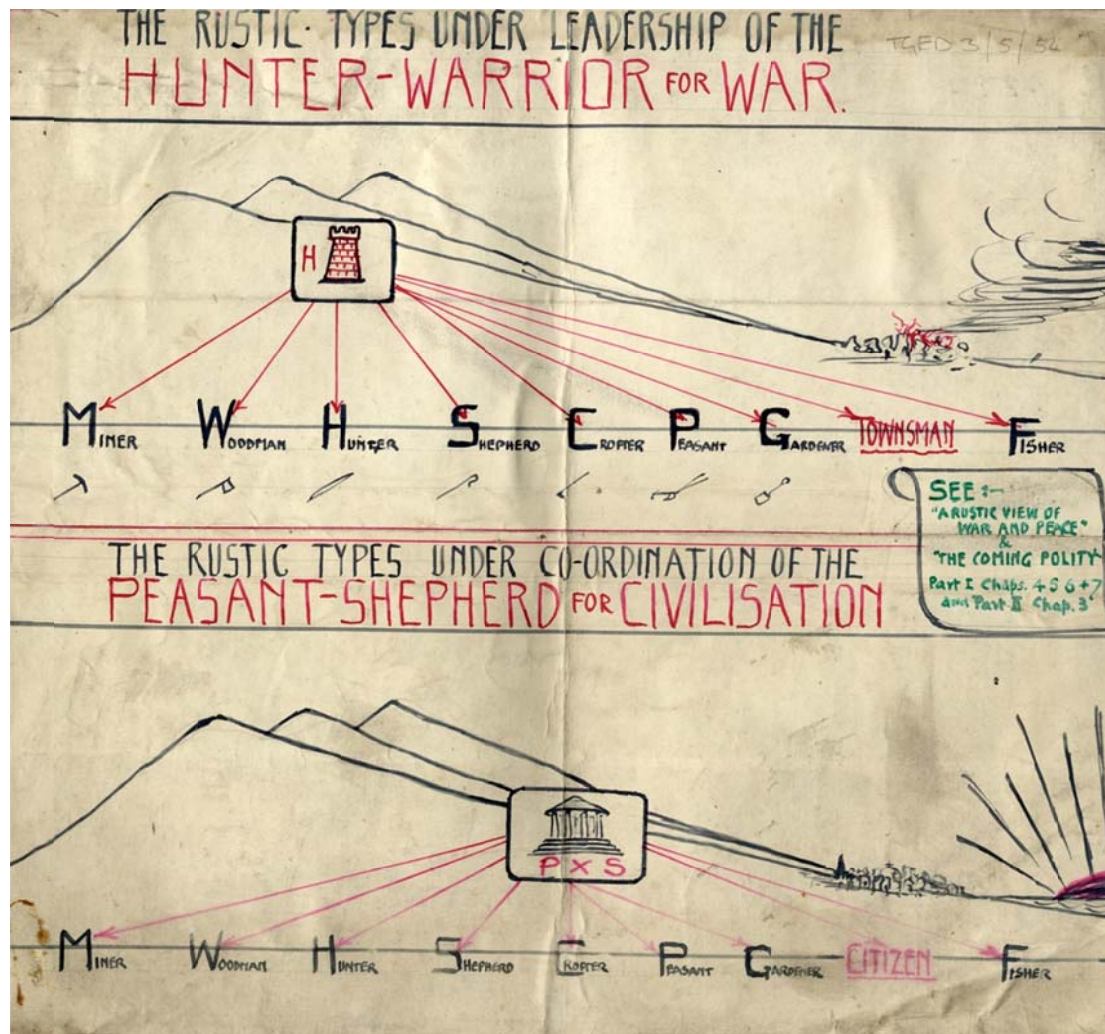


Fig. 5 - Glasgow – Strathclyde University, Special Collections, Patrick Geddes Archive.
GB 249 T-GED/3/5/54, Illustration of 'Valley Section'.

Geddes would resolve the problem by adopting a model very close to the real features of Edinburgh and the Leith valley, giving another example of the localisations of circulating knowledge. According to David Matless, in the British geography of the following decades the idea of the Regional Survey, which Geddes depicted with the Valley Section, was often represented by raised-reliefs of every region, thus literally appropriating Reclus and Geddes's original idea (Matless 2000). "There were still more means of presenting the regional survey besides photographs, slides and charts upon hills. One could scale down one's situation by constructing a relief model of the region. Fagg and Hutchings suggested carving from wood, moulding in plastic or building up in layers of card and linoleum" (Matless 1992, 468). Thus, Geddes inspired the use of relief-models as an alternative representation to flat maps, a solution which he had taken directly from the work of Élisée Reclus and Charles Perron

(Ferretti 2014b). As another effect of the localisation of knowledge, we can see the Valley Section as a Scottish adaptation of the Reclus's idea of river basin, one which clearly influenced the cultural transfer of Reclus's geography in the British world.

The Valley Section (Fig. 4) is also indebted to the overall Grand Globe project, as explicitly stated by Geddes in his 1925 paper. "Pass now to general geography and let us try to make clear its essential scenes for the drama of civilization. Here the atlas, with its flat maps, though indispensable, is far from being enough. It is this well to recall that the greatest of descriptive geographers, Élisée Reclus, with his rightly-named *Géographie Universelle*, was of all men also the most active exponent of the need for advancing beyond maps to relief-models; and thus even to his Great Globe, still to be realized in its full relief; a scheme which will make the first adequately to produce and use it the capital of the geographical sciences, and with them the economic and social. To realize any country, any region or any city, we have always first to think in terms of his relief" (Geddes 1925, 289). The anarchist geographers undertook the construction of globes, reliefs and "spherical maps", not for a positivistic aim of "accuracy", but for the strategic project of depriving the State of its monopoly of representing the world, inventing forms of cartography that they promoted as "more advanced" (Ferretti 2014b).

CONCLUSION

The present paper has shown that the collaboration between Patrick Geddes and the Reclus clan was more important in forming Geddes's ideas than has been presented until now. This collaboration was not limited to the fields of urbanism and regional planning, where Reclus's and Kropotkin's ideas on the integration of the city and countryside are recognised as the basis of Geddes's theories on regional planning, as well as Howard's Garden City proposal (Doglio 1985; Homobono 2009; Pesce 1980; Welter 2002).

If other works have stressed the role of Geddes in building up visual education (Chabard 2001 and 2008a; Von Acker 2011), the study of the network formed by Geddes and the anarchist geographers clarifies first that he was involved in their critique of flat maps as tools for geography studies and teaching. This work presents several connections with present-day debates on geographical education and its tools. As Roger Downs points out in his paper on Lucy Sprague Mitchell's (1878-1967) educational work based on children creativity and including the use of "tool maps", early attempts to render geography at school no more "boring ... mindless ... irrelevant" (Downs 2016, 8), can still provide suggestions for

performing “education as a scientific pursuit, as a collaboration between teachers and learners, as the search for first-hand and secondary data, as the study of spatial relationships, and as the inventive use of tools” (Ibid., 9). This last concept, according to Dowds, still resonates in present-day initiatives to provide primary schools with geo-software laboratories. David Lambert and Mark Jones highlight “how difficult it is [still today] to persuade new teachers of geography that a set of atlases (or interactive maps on a tablet?) may be considered to be an essential resource for teaching geography” (Lambert and Jones 2013, 6). In this sense, Geddes and Reclus’s experiments can be considered as pioneering efforts towards the (critical) construction of technical tools for multi-level geographic education. This raises also the problem of the role of knowledge in education, which is still debated: Lambert and David Mitchell have recently discussed the so-called “knowledge turn” and how it was challenged, in English secondary education, by a more pragmatic model, defined as “the beginning of a trend toward interest in the process of teaching and learning, and emphasized skills development over subject knowledge” (Michell and Lambert 2015, 371). Also in this case, Reclus’s and Geddes’s experiences can provide useful insights, by proposing a mixed solution, i.e. a model based on experience but not neglecting knowledge nor social commitment as a base for teaching and learning. In the same vein, Michael Young, David Lambert, Carolyn Roberts and Martin Roberts question what a curriculum and a geography teacher are, challenging the anxiety of teachers and school directors for indicators and official programs and claiming for the effectiveness of “knowledge for all” (Young, Lambert, Roberts and Roberts 2013, 194). On these problems, insights can be found in Geddes’s Reclus’s social projects of schooling, concerning all possible teaching levels but exemplified by the Brussels *Université Nouvelle*/New University (1894-1914), an establishment based on voluntary work, where passing exams and obtaining degrees was not the most important thing (Reclus 1895), the essential being the formation of free individuals in order to transform progressively society, a challenge still discussed by the aforementioned literature on present-day geographical education.

Geddes participated in an educational movement which argued for an active geographical education, practicing a dynamic approach to the world with walks and observations before turning to manuals and maps; and through the alliance between the Outlook Tower and the aforementioned *Université Nouvelle*, Geddes took part in the wider movement of the “libertarian pedagogy” (Codello 2005; Schmidt di Friedberg 2010; Vicente Mosquete 2007). On the political side, defining Geddes has proved difficult for all his critics: “visionary”

according to several authors, “apolitical” according to Sutherland (2009), rather “mystic” according to Welter (2002); his complex personality seems to elude any one label. Nevertheless, I would argue that Geddes’s proximity to the humanitarian socialism and educational anarchism of his time does appear clearly in the period of the Summer Meetings and the Outlook Tower. This owes something to Reclus’s and Kropotkin’s influence, but also to Geddes’s start as an Evolutionary biologist at a time when secular and rational science was endorsed by anarchists and liberals, which all claimed for a secular science (Ferretti 2014a).

Finally, the Geddes’s and Reclus’s case provides elements to answer the Rose’s question on the visual nature of geography. If “critical geographers need to explore the visualities of the discipline more carefully” (Rose 2003, 219), I should argue that the Reclus’s and Geddes’s contribution was to build geographical experiences which were undoubtedly visual, but which involved other senses and relativized, at the same time, the standpoint of the observer, trying to construct an early alternative to the dominant gaze of “imperial geographies” (Butlin, Heffernan and Morag 1995; Driver 2001; Pratt 1992) and to an idea of modernity that several authors deemed “ocularcentric” (Rose 2007, 4). This was performed through the multisensory experiences organised by Geddes and Paul Reclus in the visits to the Outlook Tower and in the walks following the model of the Valley Section, embedded in the Elisée Reclus’s critique of flat maps as instruments for communicating geographical knowledge. This anticipated some features of present-day non-representational critiques of “cartographic reason” (Farinelli 2003; Olsson 1997) and led to the experimentation of both three-dimensional objects and fieldwork external experiences. Thus, this case shows, on the one hand, that geography is not necessarily a visual discipline as it involves a plurality of sensorial gates; on the other hand, it is an early example of how visual strategies were performed among others, for educational and political aims, by geographers well aware of the power of images and of the fact that “images themselves have their own agency” (Rose 2007, 11).

ACKNOWLEDGMENTS

This research was supported by the Swiss National Foundation for Scientific Research (grant numbers 152808 and 150119). Special thanks to the staff of the National Library of Scotland, of the Strathclyde Library, and of the Geneva Public Library, and to Pierre Chabard for the materials and suggestions he sent to me. For the Kropotkin’s materials in Moscow, I acknowledge especially Sergey Saitanov and Pascale Siegrist for their help. A great thanks to

Jerry Mitchell and the other *Journal of Geography* reviewers for their precious help in improving my article.

NOTES

1. National Library of Scotland, Department of Manuscripts, Patrick Geddes Papers (referred to as NLS hereafter), MS 10564, ff. 32-33, Élie Reclus to Patrick Geddes [1901].
2. Gosudarstvennyi Arkhiv Rossiiskoi Federatsii (referred to as GARF hereafter), Fondy P-1129, op. 2 khr 824 A. Geddes to P. Kropotkin, May 10th 1887.
3. GARF, Fondy P-1129, op. 2 khr 895 P. Geddes to P. Kropotkin, September 14th 1888.
4. NLS, Mas 10564, ff 27-28, Jacob Jacobsen [Élisée Reclus] to Georges Guyou [Paul Reclus], 1898.
5. Bibliothèque Nationale de France, NAF, 22914 ff. 126-127, F. Ferrer y Guardia to E. Reclus, 1 June 1903; f. 334, lettre E. Patesson to E. Reclus, 4 September 1904.
6. NLS, MS 10564, ff. 29-30, Élisée Reclus to Anna Geddes [1898-99].
7. Bibliothèque de Genève, Département des Manuscrits, Ms. Suppl. 119, É. Reclus to C. Perron, 1 December 1895.
8. Royal Geographical Society with Institute of British Geographers, Department of Manuscripts, CB 7, Kropotkin to J. Scott Keltie, 29 January 1896.
9. NLS, Department of Manuscripts, Ms 10564, ff. 45- 48, Brussels, 6th June 1905
10. Strathclyde University Library, Geddes Archives, 13/1/2 Miscellaneous papers relating to Élisée Reclus idea of the Great Globe, Paul Reclus to Patrick Geddes, 8 August 1913.
11. NLS, Ms 10564, Patrick Geddes to Paul Reclus, 1 June 1931.
12. Bibliothèque Nationale de France, NAF, 22914; f. 334, E. Patesson to E. Reclus, 4 September 1904.
13. NLS, MS 10564, ff. 29-30, Élisée Reclus to Anna Geddes [1898-99].
14. NLS, MS 10654, ff. 56-57, Paul Reclus to Patrick Geddes, 4 May 1913.

REFERENCES

- Alavoine-Muller, S. 2003. Un globe terrestre pour l'Exposition Universelle de 1900. L'utopie géographique d'Élisée Reclus. *L'Espace Géographique*, 32 (2):156-170.
- Anderson, B. 2007. *Under Three Flags: Anarchism and the Anti-Colonial Imagination*. London: Verso.

- Avrich, P. 2006. *The Modern School movement: anarchism and education in the United States*. Princeton: AK.
- Bantman, C. 2013. *The French anarchists in London, 1880-1914: exile and transnationalism in the first globalisation*. Liverpool: Liverpool University Press.
- Bartholomew, J. 1902. A plea for a national Institute of Geography. *Scottish Geographical Magazine*, 18 (3): 144-148.
- Besse, J.M. 2003. *Face au monde: atlas, jardins, géoramas*. Paris: Desclée de Brouwer.
- Boardman, P. 1944. *Patrick Geddes: Maker of the Future*. Chapel Hill: University of North Carolina Press.
- Boardman, P. 1978. *The Worlds of Patrick Geddes: Biologist, Town Planner, Re-educator, Peace-warrior*. London: Routledge and Kegan.
- Brophy, J., Alleman, J. 2009. Meaningful social studies for elementary students. *Teachers and Teaching*, 15 (3): 357-376.
- Butlin, M., Heffernan, M., Morag B. 1995. *Geography and Imperialism*. Manchester: Manchester University Press.
- Chabard, P. 2001. L'Outlook Tower comme anamorphose du monde: Patrick Geddes et le thème de la vision. *Le Visiteur*, 7: 64-89.
- Chabard, P. 2004. Paris–Montpellier–Domme: French Migrations of the Outlook Tower, 1900–1924–1937. *Journal of the Scottish Society for Art History*, 9: 79-86.
- Chabard, P. 2005. Un éléphant blanc dans le Périgord Noir: la Tour de Paul Reclus et Patrick Geddes à Domme. *Les Cahiers Élisée Reclus*, 53: 1-2.
- Chabard, P. 2008a. *Exposer la ville: Patrick Geddes (1854-1832) et le Town Planning movement*. Unpublished PhD thesis, University of Paris.
- Chabard, P. 2008b. Towers and globes: architectural and epistemological differences between Patrick Geddes's Outlook Towers and Paul Otlet's Mundaneums. In Boyd Rayward W. (ed.) *European Modernism and the Information Society, Informing the Present, Understanding the Past*. Routledge, 105-125.
- Clout H., Stevenson, I. 2004. Jules Sion, Alan Grant Ogilvie and the Collège des Ecosais in Montpellier: a network of geographers. *Scottish Geographical Journal*, 120 (3): 181-198.
- Codello, F. 2005. *La buona educazione: esperienze libertarie e teorie anarchiche in Europa da Godwin a Neill*. Milano: Angeli.
- Cosgrove, D. 2003. *Apollo's eye: a cartographic genealogy of the earth in the western imagination*. Baltimore: The Johns Hopkins University Press.

Cosgrove, D. 2006. *Geographical imagination and the authority of images: Hettner-Lecture with Denis Cosgrove*. Stuttgart: Steiner.

Doglio, C. 1985. *La città giardino*. Rome: Gangemi.

Downs, R. 2016. Meeting the challenge of systemic change in geography education: Lucy Sprague Mitchell's Young Geographers. *Journal of Geography*, 115 (1): 3-11

Driver, F. 2001. *Geography Militant: Cultures of Exploration and Empire*. Oxford: Blackwell.

Dugatkin, L. 2011. *The prince of evolution: Peter Kropotkin's adventures in science and politics*. Createspace.

Dunbar, G. 1974. Élisée Reclus and the great globe. *Scottish Geographical Magazine*, 90 (1): 57-66.

Dunbar, G. 1978. *Élisée Reclus: historian of nature*. Hamden: Archon Books.

Dunbar, G., Rapacka, L. 1995. Two French Geographers: Paul Reclus and Louis Cuisinier *Geographers: Biobibliographical Studies*, 16: 88-100.

Farinelli, F. 2003. *Geografia, un'introduzione ai modelli del mondo*. Turin: Einaudi.

Ferretti, F. 2011. The correspondence between Élisée Reclus and Pëtr Kropotkin as a source for the history of geography. *Journal of Historical Geography*, 37 (2): 216-222.

Ferretti, F. 2012. Aux origines de l'aménagement régional: le schéma de la *Valley Section* de Patrick Geddes. *M@ppemonde*, 4, <http://mappemonde.mgm.fr/num36/articles/art12405.html>

Ferretti, F. 2013. Géographie, éducation libertaire et établissement de l'école publique entre le 19^e et le 20^e siècle: quelques repères pour une recherche. *Cartable de Clio, revue suisse sur les didactiques de l'histoire*, 13: 187-199.

Ferretti, F. 2014a. *Élisée Reclus: pour une géographie nouvelle*. Paris: CTHS.

Ferretti, F. 2014b. Pioneers in the History of Cartography: the Geneva map collection of Élisée Reclus and Charles Perron. *Journal of Historical Geography*, 43 (1) : 85-95.

Ferretti, F. 2015a. Globes, savoir situé et éducation à la beauté : Patrick Geddes géographe et sa relation avec les Reclus. *Annales de Géographie*, 706: 681-715.

Ferretti, F. 2015b. The spatiality of geography teaching and cultures of alternative education: the 'intuitive geographies' of the anarchist school in Cempuis (1880-1894). *Cultural Geographies*

Online

First,

<http://cgj.sagepub.com/content/early/2015/10/23/1474474015612731.abstract>

Fowle, F., Thomson, B. (Eds.) 2004. *Patrick Geddes: the French Connection*. Oxford: White Cockade.

2016, "Situated knowledge and visual education: Patrick Geddes and Reclus's geography (1886-1932)", **Journal of Geography**, doi 10.1080/00221341.2016.1204347 [early view <http://www.tandfonline.com/doi/full/10.1080/00221341.2016.1204347>] Page 27

- Geddes, P. 1898. The influence of geographical conditions in social development. *The Geographical Journal*, 12 (6): 580-586.
- Geddes, P. 1902a. Note on draft plan for Institute of Geography. *Scottish Geographical Magazine* 18 (3): 142-144.
- Geddes, P. 1902b. Edinburgh and its region, geographical and historical. *Scottish Geographical Magazine*, 18 (7): 302-312.
- Geddes, P. 1905a. Civics as applied sociology. *Sociological Papers*, 1: 103-138.
- Geddes, P. 1905b. A Great geographer, Élisée Reclus *Scottish Geographical Magazine* 21 (10-11): 490-496 548-555.
- Geddes, P. 1906. *A First Visit to the Outlook Tower*. Edinburgh: Geddes and Colleagues.
- Geddes, P. 1915. *The Evolution of Cities*. London: Williams and Norgate.
- Geddes, P. 1925. The valley plan of civilization. *Survey*, 54: 288-290, 322-324.
- Girón Sierra, A. 2003. Kropotkin between Lamarck and Darwin: the impossible synthesis. *Asclepio*, 40 (1): 189-213.
- Gomarasca, M. 2009. *Basics of Geomatics*. New York: Springer.
- Haraway, D. 1988. Situated knowledges: the science question in feminism and the privilege of partial perspective. *Feminist Studies* 14 (3): 575-599.
- Hirsch, S., Van der Walt, L. (Eds.) 2010 *Anarchism and syndicalism in the colonial and postcolonial world, 1870-1940*. Leiden/Boston: Brill.
- Homobono, J.I. 2009. Las ciudades y su evolución: análisis del fenómeno urbano en la obra de Élisée Reclus. *Zainak*, 31: 75-116.
- Horvath, R. 2016. Pedagogy in geographical expeditions: Detroit and East Lansing. In Springer, S., White, R., Lopes de Souza M. (eds). 2016. *The Radicalisation of Pedagogy. Anarchism, Geography and the Spirit of Revolt*. New York: Rowman & Littlefield, 101-124.
- Kearns, G. 2004. The political pivot of geography *The Geographical Journal*, 170 (4): 337–346.
- Kearns, G. 2009. *Geopolitics and Empire, the Legacy of Halford Mackinder*. Oxford: Oxford University Press.
- Kinna, R. 2016. *Kropotkin: Reviewing the Classical Anarchist Tradition*. Edinburgh, Edinburgh University Press.
- Kropotkin, P. 1885. What geography ought to be. *The Nineteenth Century*, 18: 940-956.
- Kropotkin P. 1902. *Mutual Aid, a Factor in Evolution*. London: Heinemann.

- Lambert, D., Jones, M. (Eds.) 2013. *Debates in Geography Education*. New York and London: Routledge.
- Livingstone, D. 2003. *Putting Science in its Place, Geographies of Scientific Knowledge*. Chicago: Chicago University Press.
- Livingstone, D., Withers, C. 2011. *Geographies of Nineteenth-Century Science*. Chicago: Chicago University Press.
- MacDonald, F. 2011. Technician of light: Patrick Geddes and the optic of geography. In Daniels, S., DeLyser, L., Entrikin, J.N., Richardson, N. (Eds.). *Envisioning Landscapes, Making Worlds: Geography and the Humanities*. New York: Routledge, 269- 279.
- Maitron, J. 1994. *Le mouvement anarchiste en France, vol. I*. Paris: Gallimard.
- Mather, A. 1999. Geddes, geography and ecology: The golden age of vegetation mapping in Scotland. *Scottish Geographical Journal*, 115 (1): 35-52.
- Matless, D. 1992. Regional surveys and local knowledges: the geographical imagination in Britain, 1918-39. *Transactions of the Institute of British Geographers*, 17 (4): 464-480.
- Matless, D. 2000. Forms of knowledge and forms of belonging: regional survey and geographical citizenship. In Lawson, J. and Welter, V. (Eds.). *The City After Patrick Geddes*, Bern: Lang, 91-111.
- Mac Laughlin, J. 2016. *Kropotkin and the Anarchist Intellectual Tradition*. London: Pluto.
- Meller, H. 1990. *Patrick Geddes: Social Evolutionist and City Planner*. London: Routledge.
- Minca, C. 2007. Humboldt's compromise, or the forgotten geographies of landscape. *Progress in Human Geography*, 31 (2): 179-193.
- Mitchell, D., Lambert, D. 2015. Subject knowledge and teacher preparation in English secondary schools: the case of geography. *Teacher Development*, 19 (3): 365-380
- Mowson Sullivan, E. 2013. *Patrick Geddes: Synthetic Vision*. Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University, Alexandria, VA.
- Mumford, L. 1961. *The City in History: Its Origins, Its Transformations and Its Prospects*. London: Secker & Warburg.
- Mumford, L. 1995. *Lewis Mumford and Patrick Geddes: the Correspondence*. London/New York: Routledge.
- Olsson, G. 1987. *Abysmal, a critique of cartographic reason*. Chicago: Chicago University Press.

- Pelletier, P. 2013. *Géographie et Anarchie*, Reclus, Kropotkine, Metchnikoff. Paris: Éditions du Monde Libertaire.
- Perron C. 1900. *Des reliefs en général et du relief au 1/100 000 de la Suisse en particulier*. Geneva: Stampelmohr.
- Pesce, G. 1980. *Da ieri a domani. La pianificazione organica di Kropotkin*, Reclus, Branford e Geddes, Mumford. Bologna: Clueb.
- Ploszajska, T. 1999. *Geographical Education, Empire and Citizenship: Geographical Teaching and Learning in English schools, 1880-1944*. London: HGRG.
- Pousin, F. 2012. Urban cuttings: sections and crossings. In Girot, C., Truniger, F. (Eds.). *Visual Thinking in Landscape Culture*. Berlin: Jovis, 101-120.
- Pratt, M.L. 1992. *Imperial Eyes: Travel Writing and Transculturation*. London: Routledge.
- Raffestin, C. 2007. Storia di un ruscello. In Schmidt di Friedberg, M. (Ed.). *Élisée Reclus, natura ed educazione*. Milan: Bruno Mondadori, 296-298.
- Reclus, Élie and Élisée. 1896. *Renouveau d'une cité*. Paris: Éditions de *La Société Nouvelle*.
- Reclus, É. 1894. *Leçon d'ouverture du cours de Géographie comparée dans l'espace et dans le temps*. Bruxelles: Lamertin.
- Reclus, É. 1895. *Projet de construction d'un globe terrestre à l'échelle du cent-millième*. Paris: Éditions de *La Société Nouvelle*.
- Reclus, É. 1903. On spherical maps and reliefs. *The Geographical Journal*, 22 (3): 290-293.
- Reclus, É. 1905. *L'Homme et la Terre, vol. I*. Paris: Librairie universelle.
- Reclus P. [G. Guyou]. 1902. *The Hollow Globe*. Edinburgh: Patrick Geddes and Colleagues.
- Reclus, P. 1966. *Les frères Élie et Élisée Reclus ou du Protestantisme à l'Anarchisme*. Paris: Les Amis d'Élisée Reclus.
- Reynolds, S. 2004. Patrick Geddes's French Connections in academic and political life: networking from 1878 to the 1900s. In Fowle, F., Thomson, B. (Eds.). *Patrick Geddes: the French Connection*. Oxford: White Cockade, 69-82.
- Robic, M.C. 1995. La Terre, observatoire et demeure des hommes. In Poutrin I. (Ed.). *Le XIXe siècle, science, politique et tradition*. Paris: Berger-Levrault, 113-129.
- Robic, M.C. 2013. À propos de transferts culturels. Les congrès internationaux de géographie et leurs spatialités. *Revue germanique internationale*, 12: 33-45
- Rose, G. 2003. On the need to ask how, exactly, is geography "visual"? *Antipode*, 35 (2): 212-221.

- Rose, G. 2007. *Visual Methodology, an Introduction to the Interpretation of Visual Materials*. London/Thousand Oaks/New Delhi: Sage.
- Schmidt di Friedberg, M. (Ed.). 2010. *Cos'è il mondo? E' un globo di cartone: insegnare geografia fra Otto e Novecento*. Milan: Unicopli.
- Secord, J. 2014. *Visions of science*. Oxford: Oxford University Press.
- Springer, S., Barker, A., Brown, G., Ince, A., Pickerill, J. 2012. Reanimating Anarchist Geographies: a new burst of colour. *Antipode*, 44 (5): 1591-1604.
- Springer, S. 2013. Anarchism and geography: a brief genealogy of anarchist geographies. *Geography Compass*, 7 (1): 46–60.
- Springer, S. 2016. *The Anarchist roots of geography: toward spatial emancipation*. Minneapolis: University of Minnesota Press.
- Springer, S., White, R., Lopes de Souza M. (eds). 2016. *The Radicalisation of Pedagogy. Anarchism, Geography and the Spirit of Revolt*. New York: Rowman & Littlefield.
- Stephen, W. et al. (Ed.). 2007. *Think global, act local: the life and legacy of Patrick Geddes*. Edinburgh: Luath Press.
- Stevenson, W.I. 1977. Patrick Geddes. *Geographers: Biobibliographical Studies*, 2: 53–65.
- Sutherland, D. 2009. Education as an agent of social evolution: the educational projects of Patrick Geddes in late-Victorian Scotland. *History of Education: Journal of the History of Education Society*, 38 (3): 349-365.
- Van Acker, W. 2011. International Utopias of Visual Education: the graphic and scenographic transformation of the Universal Encyclopaedia in the work of Paul Otlet, Patrick Geddes and Otto Neurath. *Perspectives on Science*, 19 (1): 32-80.
- Vicente Mosquete, T. 2007. Eliseo Reclus, educación y geografía del siglo xix al siglo xxi. In Schmidt di Friedberg, M. (Ed.). *Élisée Reclus, natura e educazione*. Milan: Bruno Mondadori, 186-227.
- Walford, R. 2001. *Geography in British Schools 1850-2000*. London: Woburn Press.
- Welter, V. 2002. *Biopolis: Patrick Geddes and the City of Life*. Cambridge: The MIT Press.
- Withers, C. 2001. *Geography, Science and National Identity: Scotland since 1520*. Cambridge: Cambridge University Press.
- Young, M., Lambert, D., Roberts, C. and Roberts, M. 2013. *Knowledge and the Future School. Curriculum and Social Justice*. London: Bloomsbury.

APPENDIX. The Hollow Globe.

Georges Guyou [Paul Reclus], The Hollow Globe, Published by Patrick Geddes and Colleagues, The Outlook Tower, Castlehill, Edinburgh; University of Strathclyde archives, Patrick Geddes Archive, T-GED-7/8/69; National Library of Scotland, Reading Room [1902]

This apparatus is a necessary adjunct to the ordinary globe in the teaching of Geography. Every teacher, now, recognises the many advantages possessed by a globe over a map, but there are also disadvantages, not ordinarily noticed, which it is the purpose of this apparatus to remove.

The great drawback in the use of an ordinary globe is that only a small part of it can be seen at one time, and thus it is difficult to grasp the relations of two places which are some distance apart. Further, with an ordinary globe, the pupil must always regard the world from a point outside, whereas more stress should be laid on the world as seen from a point on its surface.

Both these disadvantages the Hollow Globe overcomes. It shows quite clearly the relations of any part of the world to a chosen point (in this case Edinburgh) both as regards distance and direction. In addition the Hollow Globe shows a picture, when properly oriented, of the Earth's features as they would be seen from the chosen point were the Earth transparent.

The apparatus consists of a conical funnel, slightly truncated, on the inner surface of which is drawn what at first may seem an oddly distorted map of the world. Along with this is provided an ordinary globe which may be used apart for all the purposes for which a globe is used, or placed inside the funnel, as described below. On the stand a small compass has been fixed which will serve to orient the apparatus by. Across the open end of the funnel is stretched a wire, which can be removed, and which, when the apparatus is properly oriented, lies in the meridian.

To understand the means by which the map of the Hollow Globe has been obtained, it is only necessary to put the ordinary globe in the funnel so that Edinburgh comes under the eyelet provided at the centre of the wire, and the earth axis, which protrudes at the North Pole, fits into a hook a little distance apart. It is then seen by a simple comparison that the distorted map of the Hollow Globe has been obtained by a simple process of projection, for which the selected spot on the earth's surface is the centre. The features on the map of the Hollow Globe correspond exactly to those on the spherical globe. The map, however, is reversed because

we look at the countries, as it were, from underneath, seen through the earth. The distortion seems greatest for the countries nearest to the spot, but, nevertheless, it is a true representation of their aspect as seen from the point chosen.

To use the apparatus, it has only to be placed on a table and oriented by the compass. The spherical globe is put aside on the pin provided for it, and the cross wire is put in its place. Then a line going through the eyelet to a point on the map will show the exact direction in orientation, and the dip of the place from the chosen point. The direction, i.e., the angle made with the north, may be read on the scale given on the rim of the cone above the place. The dip is proportional to the actual distance of the place on the map from the rim.

The average scale is roughly 1 inch to 925 English miles (804 nautical miles or 13°24') but may be more exactly got from the scale shown on the side of the funnel. It may be checked by distances measured on the spherical globe by a tape, the scale there being 1 inch to 950 English miles.

The direction of places near at hand is often known fairly accurately; thus people in Edinburgh will point exactly or nearly so in the direction of Glasgow or Dundee, but they may have very little idea of the direction of Liverpool or London. This vagueness as to direction is increased the further off the places considered are, and, usually, when there is some idea of the direction it is wrong.

To take an example; from a glance at the map of the North Atlantic Ocean, most people would believe that Florida lies W.S.W. from Great Britain. As a matter of fact, a ship sailing there would steer in that direction after clearing the coast of Ireland. But in reality Florida lies W. by N. of Edinburgh and this is directly shown on the Hollow Globe as also the distance and the obstacle which would prevent a ship from sailing by the shortest route (great circle navigation) viz.—that Newfoundland is in the way.

It is obvious that the Hollow Globe can only be strictly accurate for the point which has been chosen as the centre of projection, in this case Edinburgh. But it is also clear that for a limited area round that point the map is practically correct, i.e., for the whole of Scotland. For the whole of Great Britain the map is true for dip, but in error for the direction in orientation for places other than Edinburgh. But, again, this error in direction is only considerable for places which are comparatively near to the selected point; when the places considered are really far off the error is for practical purposes non-existent. It has, therefore, been arranged that Hollow Globes may be supplied to suit different parts of the country, and it is requested that, in ordering, an indication should be given of where it is intended to be used.

At the base of the funnel, a strip of paper has been put on the stand with the points of the compass indicated on which the direction of places in the immediate horizon may be drawn. This is particularly useful for school work. By special arrangement, again, teachers and others may have the horizon sketched in on this strip by the makers of the Hollow Globe.

The value of this apparatus to teachers as an aid in stimulating the imagination of children, and as making them see the world in a new aspect, is obvious. Every effort is made, now, in education to make the pupil regard things from more than one point of view, and it is hoped that this apparatus will serve to give the pupil a new interest in the world in which he lives. It has this great advantage over ordinary maps that it begins with what the pupil actually sees, as he sees it, and the child's imagination is helped to expand this picture until it embraces the whole world as he would see it if the sphere were of glass.

MORE MATERIALS FROM GEDDES'S ARCHIVES [not included in the published paper]

Letter from Élisée Reclus to Anna Geddes

NLS, Department of Manuscripts, Ms 10564, ff. 29-30 [1898-1899]. [Original in French, translated by the author]

Madame Patrick Anna Geddes
University Hall

My dear lady and friend,

I am sending the article you requested, which will arrive, I hope, in the time allowed, maybe before Geddes's, which you said was late.

In London, and in Geneva by letter, I dealt with the raised-relief of Southern Scotland between Dundee and Northumberland. The correspondent from Geneva, my usual cartographer [Charles Perron], wrote to me that if we already have all of the region's maps with contour lines, the work altogether will cost probably £1650. My friend Guyou, in London, with whom I had a very serious discussion about the matter, still has not come up with an estimate and doesn't think he can until he knows whether hypsometric lines exist for the entire region; but his impression is that the work will be neither long nor very expensive.

We are pursuing this matter so as not to blindly embark on an enterprise which could be of great interest and should not be undertaken if it cannot yield absolutely perfect results. Moreover, if the budget of the geographical museum does not allow one to make the raised-relief proportional to all of Southern Scotland, the most important fragment of this region, the isthmus strictly speaking, between Forth and Clyde, would already offer the most attractive and instructive of pictures.

Please remember me to your husband and commend me to all the citizens of the *Cité du bon accord* whom I had the chance to meet and appreciate. I don't need to reiterate how much I was touched by the kindness and warmth with which you welcomed me to your home.

Élisée Reclus

Double letter from Paul Reclus (on behalf of Élisée Reclus) to Patrick Geddes

NLS, Department of Manuscripts, Ms 10564, ff. 45- 48

26 rue Vilain XIII

Brussels, 6th June 1905

Dear Sir,

Mr Élisée Reclus is away from town and I have no time left to communicate with him before the wealthy assembly. Carrying his entire sympathy with Prof. Geddes and his work at the Outlook Tower, I have written the enclosed letter. Please consider it as a draft and make any change which might be deemed necessary especially from the point of view of good English.

I take this opportunity to remember you to Georges Guyou and to send his very respectful regards.

Yours truly

Paul Reclus

Georges Guyou

26 rue Vilain XIII

Brussels, 6th June 1905

M. Élisée Reclus desires to send to the Outlook Committee his desire that a way may be found to present and to develop that institution.

He fully recognises the far-reaching method which prof. Geddes has done his best to render visible in the successive floors of the building.

The Outlook Tower is an important educational museum which addresses itself to the man as a whole, which tries to watch in him the thoughtful, the educational and the observing institute alive and then to enlarge his synergetic value.

In the future there will be plenty of these institutions, no doubt better equipped than the Outlook Tower, but none in such an exceptional situation, between sea and volcano, busy Princess Street and lonely Pentlands, [...] and High Street, for ever puzzles to the wondering man

May the workers fill the Outlook Tower with a new *ardeur*.

Élisée Reclus

M. Élisée Reclus offers to send his bibliography and any geographical subject, and to create as an information bureau for it, suggesting that the Outlook Tower and the Geographical Institute in Brussels should be affiliated, and mutually take advantage of each other's resources.

Letter from Paul Reclus to Patrick Geddes

NLS, Department of Manuscripts, Ms 10564, ff. 56 57

Ixelles-Bruxelles 4 Mai 1913

Paul Reclus, Ingénieur ECP

rue Émile Banning 15 Ixelles

Dear Prof.,

I saw Al[asdair] yesterday and he thought best I should write to you about what we are doing. I have gathered a good many plans, charts and drawings among which you can make a selection of things which interest you. Besides, here you are a few of the suggestions I am following now.

1. Evolution of river-section. Six or seven superposed diagrams, down below, the purely geographical one, then primitive occupations, evolution, displacement and integration of these, up to the state of things of to-day, with peasants and factory hands, tunnels bored, and so on. I think the diagram should bear no name; at least the river should not. My difficulty is that among the well-known rivers of Europe, there is no one which answers really to the diagram: Elbe, Rhine, Rhône, and Danube are traversing intermediate mountains; Vistula, Oder, and Seine hardly come from mountains. Loire and Garonne would answer best, but the towns on their banks are not always characteristic.

2. Classification of principal towns. Horizontally, 14 or 15 *Paysages urbains typiques*, Cliff harbours, Dover or Marseille; Estuary-Bridge-town, London or Hamburg; Confluent-bridge town, Lyon or Paris; Centre-of-basin bridge town, Wien or Dresden; Lake town, Genève or Zurich, and so on. Vertically all the leading towns of Western Europe with the different types they belong to, for example:

X Breslau-type

X Berlin-type

X Gov[ernment] seat type

3. Different growths of town, about 20 examples; Wien or Strasbourg, away from and towards the river. West-endy towns. East-endy towns. One street town. Circular town. Simple and composite towns. Castle towns. Railway towns. And so on.

4. Geographical environment of *Kulturstädten*: Susa, Nippur, Babylonia, Nineveh, Jerusalem, Thebes, but I am not yet quite clear about the form which that diagrams should take.

I would be glad to hear your ideas and suggestions.

Ever yours

Paul Reclus



Fig. 6. Strathclyde University Library, Geddes Archives, 13/1/2 Miscellaneous papers relating to Élisée Reclus idea of the Great Globe, postcard from Paul Reclus to Patrick Geddes.

The Great Globe

Strathclyde University Library, Geddes Archives, Miscellaneous papers relating to Élisée Reclus's idea of the Great Globe

The conception of geography as the Science of the Earth as a whole and as embodying results of the exploration of all its regions has of recent years been receiving increased recognition.

It has been the fashion hitherto to regard science as a group of Specialisms, to some extent indeed related, but not always or necessarily so. But since each special 'science' necessarily deals with some aspects of our environment, it may reasonably be argued that each is thus but one department in the larger science – that of Geography – each such Science a 'Geolysis'.

Evidences of the changing point of view are daily becoming more apparent – the present period in many directions one of Encyclopaedic organisation of information as opposed to critical analysis of separated bodies of facts. Noticeably too there is at the moment a return

to Geography to the study of the earth, in Scientific and popular interest – Zoologists, Botanists, Chemists, Geologists, etc., becoming geographers, whilst on the popular side the lively interest shown in the work of Nansen and others, and the increased publication of various popular atlases may be cited as evidence.

To express this geographical conception of Science in more concrete and therefore more scientific form, and thus define and meet the widely felt want, is accordingly of the first importance.