Between the Local and the Global: History of Science in the European Periphery Meets Post-Colonial Studies

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Abstract. The aim of this paper is to discuss two historiographical issues pertaining to the history of science in the European periphery. The first issue concerns the wide use of the centre-periphery dichotomy in historical accounts discussing the diffusion and institutionalization of science across the world. The second issue concerns the use of appropriation (instead of transfer, or adaptation) as a means to overcome the diffusionist model in history of science. Recent work at the intersection of history of science with post-colonial studies will provide the framework for reassessing these matters. As it will be shown, theoretical discussions about the history of science in post-colonial context can help historians overcome the centre-periphery dichotomy and turn European periphery into a privileged standpoint for showing the actual diversity of 'European science.' At the same time, the experience of post-colonial studies can also help sharpen the historiographical tool of appropriation. The assumption that will be made is that by focusing on appropriation rather than on discovery and innovation (the favourite categories of much of mainstream historiography), or on transfer and adaptation (the favourite categories of the diffusionist model), historians of science can not only set aside the artificial distinctions of the diffusionist model, but also bring forward the re-inventions, the conceptual shifts and the cultural adjustments, which are responsible for the emergence of science as a global phenomenon *in the periphery*. Especially concerning European periphery, the use of appropriation may bring forward the particular historical circumstances under which certain knowledge patterns gained universal epistemic authority *as constitutive elements of an imagined European intellectual identity*.

Keywords. Appropriation of knowledge, centre-periphery dichotomy, European periphery, globalization of knowledge, post-colonial studies, STEP

1. The Local and the Global

The aim of this paper is to discuss some historiographical issues pertaining to the history of science in the European periphery. In recent years, a number of initiatives have been developed to revise a broad spectrum of issues relating to local historiographies of science and technology in Europe. Although highly diversified and multi-faceted, these initiatives offered many historians the opportunity to overcome the constraints of their local framework, often dominated by strongly positivist attitudes, and explore new

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ways to connect their research with mainstream historiography. Naturally enough, this led to a variety of approaches, but it also favoured the emergence of some recurring motifs. At the same time, though, things had been changing in the broader context. The intersection of history of science with social anthropology, linguistics, post-colonial studies etc. would inevitably have some effect on the history of science in the periphery. Hence, a discussion about the relevance of the local history of science to the broader discipline unavoidably involved a rethinking of the local endeavours in light of such issues. The aim of this paper is to focus on two of the main motifs, which kept recurring in this discussion, and examine how they can possibly function as bridges between the local and the global. The first of these motifs is the centre-periphery dichotomy and the second is a historiography built around the notion of appropriation as opposed to a historiography based on the diffusionist model. Recent work on the borderline between history of science and post-colonial studies will be taken into account to accommodate the problematique of the paper and provide an appropriate context for reassessing the stakes of the historiography of science in the European periphery.[1]

2. *A New Step in Science History*

One of the initiatives that have provided a forum for reconsidering the history of science in the European periphery is STEP (Science and Technology in the European Periphery), which came to life in June 1999 in Barcelona.[2] The common feature that connected the historians who made up the group was that they worked in the 'periphery' of Europe. Apparently, 'periphery' is a highly ambiguous term since it connotes a plethora of meanings of historical, sociological, political and anthropological origin. An early statement of the group addressed the issue along the following lines:

> One of the most intriguing challenges for historians of science, technology and medicine is, perhaps, to try chart their own thematic atlas within this geographically expanding and culturally diverse Europe, whose present configuration provides a unique opportunity for symbiosis between established and emerging communities of historians of science. Members of newer communities will soon have to decide how to recast what have often, and for many years, been local topics in ways that can be linked to contemporary historiography of science (...). Although a simple bipolar distinction between center and periphery is useful for broadly delineating the situation, it is incapable of capturing many salient details. There are many centers and many peripheries, and they change in time, spaces, and disciplines. Depending on the subject one is discussing, a place may at one and the same time be both center and periphery. A center may, over time, change into a periphery, and vice versa. And a single country may contain both centers and peripheries, thereby making purely national distinctions of dubious use. To examine such issues requires discussing the ways in which ideas that originate in a specific cultural and historical setting are introduced into a different milieu with its own intellectual traditions as well as political and educational institutions.[3]

The time that has elapsed since this statement was written has witnessed a significant number of conferences and publications that have explored various aspects of these

topics. At the same time, though, as the landscape in history of science *and* the humanities shifted, historians of science in the European periphery were faced with some important theoretical challenges. Evidently, a convincing response to these challenges would greatly determine the nature of their future contribution to the discipline. Thus, in a paper published a few years ago, the authors brought up an important issue: The relationship between the history of science and technology in the European periphery and the history of science and technology in the context of post-colonial studies. Their major claim was that there are significant similarities as well as important differences. Concerning similarities first: Both European colonies and the countries of the European periphery are generally considered passive receivers of the scientific developments of the centre falling under the interpretational scheme of Basalla's three-stage model (Basalla, 1967). The active role of the local scholars in shaping and even restating the scientific ideas goes usually unnoticed and when it doesn't it is because the periphery (either colonial or European) is taken as supplier of raw data for the established science of the centre. From this point of view, a historiographical enterprise aspiring to explore the 'epistemologically active role of the colonies as well as the dynamic interaction between metropolis and colonies in the exchange of scientific knowledge' (Gavroglu et al., 2008, p. 158) may also be applied to the European periphery changing its historiographical status in history of science.

On the other hand, colonies exhibit significant differences from the countries of the European periphery. These differences result from their different political status. The colonies experienced the presence of an external power imposed on their local cultural life and priorities, which in many instances created conflict with the local traditions. This was not the case in the countries of the European periphery, where disagreements often resulted from diverging interpretations of the local traditions. As stated by the authors of the paper, in the colonies 'the whole enterprise of scientific practices and technical innovations is within the well-defined context of colonial politics [whereas] various scholars in the European periphery regard the sciences and technical innovations as an integral part of their local political, ideological, educational and even religious agendas' (Gavroglu et al., 2008, p. 159). Thus, notions of locality and of locally originating intellectual pursuits play a significant role in separating the historiography of science in the European periphery from that in the colonies.

However, in light of recent work at the intersection of history of science and post-colonial studies[4] it becomes evident that historians of science in the European periphery can move beyond such artificial distinctions. Apart from issues of similarities and differences between European and colonial peripheries, there is the intriguing question as to where and how the respective historiographies of science intersect. Thus, the central issue this paper is going to deal with is to what extent the intersection of these two historiographies of science can provide ideas, methods, categories and problems which may creatively affect each other.

3. Beyond Centres and Peripheries

The centre-periphery dichotomy is undoubtedly a difficult but also challenging issue. Although for a long time it kept recurring in most of the discussions concerning the history of science in the European periphery, historians were quite reluctant to touch upon its sensitive implications. On the other hand, the centre-periphery dichotomy in history of science was instrumental in spurring productive exchanges among historians working in (or on) the periphery. These historians had often found themselves trapped between the Scylla of parochialism of the local historiographies and the Charybdis of the centre-bound narratives of mainstream historiography of science. Hence, it was important for them to find a way to explore the uncharted local expressions of scientific thought and practice, overcoming both the limitations of local historiography and the exclusions of mainstream history of science. As stated in STEP's foundational text, historians had to establish a new research agenda beyond the received taxonomies of the profession and especially beyond 'reception studies' and the diffusionist model, which backed the centre-periphery dichotomy. Under no circumstances, of course, was the contribution of 'reception studies' considered unimportant. On the contrary, most historians would readily agree that such approaches not only helped science studies in the periphery acquire a pronounced status, but also brought to the surface the multifarious relationships of science with the local socio-political factors. And, most importantly, such fields as colonial and imperialism studies cast light on the intricate political relationships between centres and peripheries, stimulating the methodological reflexes of many historians. In a sense, the attempt to redraw the agenda of history of science in the periphery was a mature fruit of such considerations. But it also aspired to set the ground for a new approach that would renew their dynamics.

The centre-periphery model upon which both reception studies and the various local historiographies of science were based has long been present in the discipline. The very idea of such a distinction seems to have originated in the writings of the American sociologist Edward Shils, who used it for the study of international relations in the context of colonialism (Shils, 1961). Shils also founded and directed *Minerva*, a journal devoted to international science policy, which hosted a significant number of papers reinforcing the centre-periphery distinction (for a comprehensive list, see Guillem-Llobat, 2008, p. 297). In Shils' writings, the notions of centre and periphery were employed to explain the variation in the cohesiveness of different societies, or of the same society at different periods. Neither of these notions was meant in geographical terms. They were rather conceived as structural elements of a society representing the relative density of institutions, authorities and symbols of unity. The centre is the location where such dynamic is more concentrated exerting centripetal forces on the periphery. Periphery, on the other hand, is the wide area where less active individuals, followers and even disloyal dissidents are dispersed (Bulmer, 1996, p. 14; Orlans, 1996, p. 25). As far as the sciences were concerned, Shils stressfully emphasized his belief that scientific *truth*, as opposed to the various forms of

scientific *activity*, is universal. The consensus on the universality of particular scientific propositions and the respective criteria of validity forms the basis for the construction of scientific communities and legitimizes the 'inequality of status of centre and periphery' within these communities (Shils, 1991, especially pp. 409, 412, 414–415, 417).

Another well-known approach was George Basalla's model that set out to explain how by means of western technology the colonial societies passed from a subaltern status to successful incorporation into the developed world. In the beginning of their relation with modern science and technology many of these societies were confined to the role of raw data suppliers. As we shall see in what follows, this turned out to be the most powerful point of Basalla's scheme, as it is still found in the core of many studies on science and empire. However, what assigned the name 'diffusionist model' to this scheme was the second stage, i.e. the contact of the colonial societies with modern science and technology. This stage involves the emergence of 'colonial science,' which is marked by the dependence of the local scientific life on the established research agendas of the centre. The definitive overcoming of the various cultural impediments, which prevented the establishment of the scientific culture, eventually leads to the third stage. Through the general acceptance of the methods and values of modern science and technology, the colonial society builds its own scientific and educational institutions, securing its independence and its participation in the developed world — the kind of social arrangement which is usually characterized as progress (Basalla, 1967).

Both Shils' centre-periphery dichotomy and Basalla's three-stage model have been widely employed by historians working on science and empire. At a time when modernity theory reached its high noon, it seemed quite plausible (although Shils would disagree with this) to causally associate the Western dominance over the rest of the world with the integrity and the efficacy of Western science. However, very soon this well-intentioned humanist explanation lost its innocence. Marxist criticism of neo-colonialism focused on the role played by science in colonial expansion. Although Basalla's scheme retained its relevance, science was increasingly incriminated as one of the main instruments of imperial control over the colonized societies. In this context, dependency came to be seen as intrinsic to the scientific relations between imperial centres and colonial peripheries. Science did not mark the gradual incorporation of the colonies into a universally valid system of political and economical development; it rather asserted a distribution of power between the truly independent metropolis, which produced and validated knowledge, and the dependent periphery, which was regulated and controlled by that knowledge.[5] The emphasis placed by Western science on laws and classification shaped a language of command, which contributed to racializing people and ordering nature across imperial realms. As native knowledge was in principle considered non-scientific, the talk of science and imperialism inevitably led to the separation of the local from the universal and turned historians toward the study of the particular circumstances which enabled the latter to subdue the former (Harrison, 2005, pp. 61–62; Roberts, 2009, pp. 13–14; Sivasundaram, 2010b, pp. 154–155).

For many years the opposition between powerful centres and subjugated peripheries and the instrumental role of science in the institutionalization of this opposition formed the core of post-colonial critique of European imperialism. More recent contributions, though, assert that this critique has approached its theoretical limits and that perhaps we should be looking 'toward alternative models that do not reinforce the omnipotence of the imperial center at the expense of local or moving platforms of knowledge creation' (Safier, 2010, p. 143; notice the association 'local or moving platforms of knowledge creation'). However, before joining recent historiography in discarding the diffusionist model and theories of dependency in favour of more flexible and balanced approaches, one needs to assess another reason for the persistence of that model: Europe.

The situation in history of science concerning Europe is significantly different than that in post-colonial studies. Most of the works that refer to the introduction of modern science in the countries of the European periphery move around a dipole. At one pole are those historians who identify the Enlightenment as the central event in the process of modern Europe's formation. What they attempt to prove is that 'periphery,' namely societies which did not originally participate in the formation of Enlightenment's ideals, nevertheless acknowledged the value of these ideals, and thanks to adequately enlightened representatives made significant (and in the long run successful) efforts to incorporate them. Science functioned as a vehicle for Enlightenment's ideals. Many local scholars dealt with the sciences without, however, getting involved with original research. For such people the replication of Enlightenment's scientific ethos in their local context was not primarily a prerequisite for initiating scientific pursuits, but the means for fighting cultural backwardness and restructuring society on the basis of reason.

The other pole is populated by historians who perceive the heroes of the periphery as unappreciated contributors to the 'real' history of Europe. In the context of this approach Enlightenment itself is not central, although a key role is retained for some of its core ideas: Reason, the pursuit of unique truth and the rationalization of religion. According to this group of historians, the origins of what is now considered typically European in philosophy (including science), religion and politics must be sought in traditions originating in areas, which are now located in the European periphery, or even beyond it. The glorious Islamic past of Europe or the ancient Greek heritage offer persuasive vindication for the periphery to assert itself as an integrated part of Europe. Science is again crucial in the sense that it represents some of the most significant fruits of past traditions, which matured in the hands of modern Europeans. An alternative version of the same approach aims at bringing forward the direct contribution of the periphery to modern science. People who discovered natural laws and foresaw principles of modern science like Ørsted or Bošković (but also like many others whose names and contributions went unnoticed) feed a significant part of this historiography either in national or in international contexts.[6]

Although the two groups of historians seem to differ in their perception of the periphery, they significantly share a common view of Europe: Europe is the

unquestionable culmination of modern civilization and the participation in its becoming marks the cultural maturity of a society. In this respect, by asserting the peripheral status of their societies, historians assured their position in a unique course leading to European integration. Being on the periphery was not really a drawback. The crucial point was that, due to their intrinsic qualities and powers, peripheral societies were in a position to follow and eventually incorporate the civilizational patterns representing Europe. Thus, for a number of social formations which did not actually mark European culture with distinctive attainments, dependency became a way to establish themselves in the vicinity of Europe. For, as a Greek historian eloquently noted,

> Europe is quite something. No matter how much we extend our consciousness in order for our affection and responsibility to include the human presence everywhere in the world; Europe is still a reality, which has not yet exhausted its content and whose historical destiny keeps occupying our minds. *There is indeed something which is a European people*.[7]

And, of course, the question of how to become incorporated into *this* people is a serious national concern for most countries of the periphery. (About how idealized this view of Europe was during the Enlightenment, see Verga, 2008).

The centre-periphery distinction is, thus, a recurring theme, both for the local historiographies in the European periphery and for the broader community of historians of science. And this is especially so because, although science has been broadly perceived as an expression of authority, which served particularly well the separation of the local from the universal, this separation did not affect the historical works written for the colonies and for the European periphery in a symmetric manner. In the case of colonies it gave rise to a critical discourse, which sought to bring forward the epistemically active role of the periphery, while in the case of the European periphery it promoted a historiography seeking to defend the European profile of the 'peripheral' societies.

Recent science studies in the European periphery have made a significant, though far from homogeneous, contribution in showing the limitations of such a conceptualization. The historians leading these studies rehearsed various historiographical methods in their bid to delineate the epistemological and social dimensions of knowledge production in the European periphery: Studying the itineraries of travelling individuals they pointed to the building of networks between scientific centres and peripheries; focusing on the metamorphoses of the written word they indicated the fluent character of knowledge and the impact of the socio-political context on the local scientific discourses; adopting the comparative approach they highlighted the varied nature of the intellectual currents cutting across centres and peripheries, etc.[8] What is still missing, however, is a more definitive critical transcendence of the centre-periphery dichotomy. Due to the deep rootedness of this dichotomy in many local historiographies of science within Europe, a broad consensus among historians is necessary to undermine its lasting influence. And it is noteworthy that this consensus has already been achieved in the context of post-colonial and globalization studies. Thus, we may aptly ask, how could scholars working

on the history of science and technology in the European periphery profit from the experience of post-colonial studies on this matter?

One important development in post-colonial studies pertinent to the historiography of science in the European periphery is the historical deconstruction of Europe's centrality. It is now well documented that, until the Enlightenment, Europe was only a peripheral power as compared to the thriving Asian-centred economies and cultures (Gran, 1996; Gunder Frank, 1998). Beyond this indisputable fact, however, what is more important from our point of view is that the very idea of a European identity was to a significant extent built outside Europe, in the colonies.

For many centuries, Europe had been depicted as a queen whose mysterious body was able to simultaneously contain many people(s) of different origin, ethos and civilizational status. Since the mid-18th century, scholars started contrasting Europe with other areas of the globe and especially with an (idealized, of course) despotic Asia, against which Europe developed its particular moderate political status and a 'genius for liberty.' Thus, otherness (as opposed to the prior comprehensiveness) came into play: Europe — indeed a French Europe, extending only as far as the Berlin meridian — was more civilized, rich and enlightened than any other part of the world (Verga, 2008, pp. 354–355). In this respect, Europe's history was identified with the gradual unfolding of a globally unique civilization in all spheres of social, political and intellectual life. But it was colonialism rather than the Enlightenment that turned this abstract perception into a real urge for a shared European identity.

Recent decades have witnessed a growing body of works focusing on the groups of white people, like the Dutch settlers in the East Indies or the local-born Creole 'whites' in the Caribbean who, in their bid to secure a set of cultural features, which would permanently separate them from the poor whites, the *Negro* and the *mestizo*, developed for themselves the image of 'European.' The distance from the mainland and the mix of cultural and national influences in the theatre of the colonies favoured the compilation of an all-encompassing prototype, representing the values of an imagined superior civilization. Colonial centres, in particular London, Amsterdam and Paris, latched onto this prototype, which formed the basis of theoretical discussions that ultimately led to the emergence of a European sense of self based on such dichotomies as white/non-white, civilized/savage, European/non-European and, eventually, Western/non-Western (Mitchell, 2000b, p. 4). Of course, this is only a sketch of a long and complex process, but what is important for our study is that the work of a number of scholars convincingly documents the formation of a number of distinctly European qualities in the colonial periphery (Stoler, 1989, 1997; Anderson, 1991).

Along the same lines, there is an increasing emphasis on the fact that capitalist modernity, which is commonly understood as a process developed in Europe and then spread to the rest of the world, cannot be accounted for if we confine the framework of our narrative within the boundaries of Europe alone. Immanuel Wallerstein insightfully

noted, 20 years ago, that a proper image for the development of the modern world-system is 'not of a small core adding on outer layers but of a thin outer framework gradually filling in a dense inner network' (cited in Mitchell, 2000b, p. 2). The transcendence of eurocentrism brings forth the expanded network of exchanges, which gave simultaneously birth to modernity and to its favourite agent, the 'West.' Beyond Great Britain, the Netherlands and France, the sites of such exchanges were also (and for a long time, *primarily*) the East Indies, the Ottoman Empire and the Caribbean. The organization of sugar production in 17th-century Caribbean, which necessitated a detailed management of time, precision and technical skills, set the ground for the industrial organization of labour in early capitalist Europe. The long distances crossed by colonial commodities across the globe stimulated the development of a bureaucratic control of work in port-cities and on board the ships that paved the way to the elaborate methods of surplus value extraction. Jeremy Bentham's *Panopticon* principle, embodying self-monitoring as 'a new mode of obtaining power of mind over mind, in a quantity hitherto without example,' was first developed by his brother Samuel in the borderland between Russia and the Ottoman empire, where he directed various industrial and military projects for Prince Grigory Potemkin. And, surprising as it may sound, the academic discipline of English Literature, before its appearance in England, took shape in India as a tool of character formation for the middle classes of the colonized population (Mitchell, 2000b, pp. 2–4, where also more examples and the respective bibliography). In light of a growing number of studies, one is tempted to state that far beyond the Enlightenment, it was colonialism that shaped modern European identity as well as the organization of labour and social life that came to represent 20th-century capitalist modernity.[9]

What about science, then? Although Europe as a cultural idealization and as the hub of modernity might actually be the product of a global process, which in the course of time crystallized into particular power schemes, is it possible to deny that it was Europe, after all, that gave birth to modern science and technology? It seems that research in early modern science has also cast significant doubt over the perceived monopoly of Europe on scientific and technological innovation. Not only significant parts of what has long been considered genuinely European or Western science turned out to be products of other localities, but also national historiographies of science feel the pressing need to cross their territorial borders in order to make their object sensible (Raj, 2007, p.11). As it was eloquently stated in a recent collection:

> Studies of sixteenth and seventeenth century textile printing and dyeing, of medical botany and chemical hardware, have shown clearly how the received geographies of technical diffusion must be redrawn, with renewed emphasis on Asian economic dynamism and on the crucial significance of regions such as the Mediterranean and the Atlantic networks wrongly judged either marginal to, or entirely dependent upon, a supposedly dominant north-western European centre (Schaffer et al., 2009, p. xxi).

As a consequence, a growing number of recent historical works move beyond the received view of science as Europe's legacy to the rest of the world and seek to

describe it as a global phenomenon reflecting a shifting balance of epistemic power amongst 'centres' and 'peripheries.' In this context, scientific knowledge has been increasingly treated as a co-production equally involving the dominating metropolis and the dominated colonies. Scientific ideas and practices did not spread to the colonies as immutable commodities already built and stabilized in the metropolitan workshops. Notwithstanding the asymmetrical character of such interactions, the production of new knowledge was the result of continuous and reciprocal exchanges between different and perpetually shifting localities (Safier, 2010, p. 145). The 'centres' had moved to the 'periphery' by embracing particular epistemic values of the latter, while 'peripheries' valued the 'centre' by appropriating particular cognitive attainments of Western thought. In this respect, the appropriation of scientific knowledge ...

> was not a phenomenon limited to colonies and 'developing countries.' It encompassed the entire globe, enveloping all regions and all aspects of history within its purview. The history of science is thus a global history, both because it is embedded in the broader context of history, *but also because it has no privileged place of origin: it is a constantly developing consequence of circulation*.' (Roberts, 2009, pp. 24–25; emphasis is mine).

This shift of focus from locality to circulation involves the idea that circulation is not only a matter of moving pieces of knowledge but also — indeed, primarily — a process of knowledge production. Thus locality, far from being definite and immutable, becomes a product of history, continuously reinventing itself through actively appropriating objects, ideas and practices that cross its borders (Raj, 2007, pp. 20–21; see, also, Raj, 2010, p. 517 and Appadurai, 1996, p. 18). This acknowledgement has an important historiographical consequence. The colonial periphery forms a privileged point of view for historians of science to better understand the complex processes which consolidated Western science and legitimized its claims on universality. Viewing the history of science from outside the consensually agreed 'centres of scientific activity' allows historians to trace the ways in which concepts and practices acquired their epistemic status by moving across different cultural environments and social contexts.[10] More importantly, it helps explore the historical circumstances under which particular geographical sites got intrinsically connected with the state of valid knowledge, while others were deemed to need the mediation of European institutions in order to be able to participate in the realm of valid knowledge.[11]

How does this change in historiographical views mesh with the study of science and technology in the European periphery? As mentioned above, many European historians and historians of science are tied to the conviction that belonging to the periphery of Europe secures a European (that is 'civilized' and 'progressive') identity. Working on the history of science in the European periphery, however, does not necessarily mean that historians aim at doing justice to the unsung heroes of the periphery, or at restoring the contribution of the peripheral countries to the glorious edifice of modern science. Apparently, an important dimension of the work of historians who deal with local issues relates to the unearthing of unknown sources, and to the discussion of the

historical circumstances under which modern science and technology were established in particular contexts. At the same time, however, in a number of works the European periphery emerges as something more than a historical and a geographical context: the European periphery can also be a *historiographical standpoint*. As in the case of the colonial periphery, standing on the European periphery offers a clearer view of the intricate ideological constructs involved in the establishment of science and helps unveil the social arrangements and cultural decisions informing their consolidation (Gavroglu et al., 2008, p. 168).

There might be something particularly new, however, in the relocation of the historiographical viewpoint from the colonial periphery to the European periphery. Even in the most radical critiques of the diffusionist model, the terms 'European' and 'Western' are extensively and indiscriminately used. And although the centrality of both Europe and the West has been critically reassessed, the question remains, what do we mean when we talk of 'European science?' Taking the European periphery as a standpoint brings to light the significant asymmetries of 'European science.' Although such asymmetries might not be visible from the perspective of the centre or of the colonial periphery, standing on the *European* periphery helps make clear that what we now tend to perceive as constitutional aspects of modern science, throughout the 18th and a significant part of the 19th centuries were, in fact, highly diverging 'projects of enquiry' (Cunningham and Williams, 1993, p. 420). It is hardly known today, for example, that in early 19th-century Naples there was an intense controversy over whether analytic or synthetic methods should be used in geometrical problem-solving. Analysis, glorified by many 'orthodox' Newtonians of the Enlightenment, involved the application of calculus to empirical problems; synthesis, primarily based on the reconstruction of ancient mathematical works, aimed at using geometry to pursue eternal truths. The particular intellectual environment of the kingdom of Naples, permeated at the time by significant political, educational and religious turbulences, favoured the immediate confrontation of the contrasting views (Mazzotti, 1998). Far from being a clash among conservative, peripheral and progressive, centre-oriented mathematicians, the particular debate reflected an open discussion about the use and the validity of mathematics. The followers of the synthetic school who were, in fact, well aware of the mathematical work of d'Alembert, Lagrange and Monge, maintained that analytic methods reduced the world to a mere material accumulation contributing, thus, to ethical corruption. On the contrary, they assumed, 'pure' mathematics, aiming at deciphering the geometrical skilfulness of God, supported righteous character formation and fought religious heterodoxy. The episode makes visible the diverging views about the ontological status of mathematics — significantly present at the centre, as well (Ahnert, 2004) — and the undecided balance of power between different aspects of mathematical practice in (not so) early European science.

Even more fundamental aspects of science came under scrutiny, during a similar time period, in a geographically adjacent, but culturally entirely different intellectual context. In the Ottoman-dominated Balkans, a considerable number of scholars worked

towards establishing a philosophical discourse that would infuse the Greek intellectual life with the latest developments in natural philosophy. Most of these people had studied in European universities and had embraced Newtonian natural philosophy. It is puzzling, however, that although they praised the discoveries and the methodological achievements of the moderns, they manifestly abstained both from experimentation and from the application of mathematics in natural philosophy. Notwithstanding their competence in both areas, they seemed to be more interested in integrating the findings and the methods of the new natural philosophy with their traditional philosophical apparatus, the Paduan naturalistic neo-Aristotelianism. Thus, for example, the major point about the Newtonian concept of *vis inertiae* was not how it would help remove the metaphysical category of matter from the equations of motion, but how the particular concept would be established as a manifestation of matter in its most profoundly Aristotelian sense (Patiniotis, 2007). Along similar lines, in a number of treatises, the atomic structure of matter is taken to form an alternative expression of the traditional hylomorphism, infiltrated through the discoveries of the moderns. Taking such considerations seriously and not as indications of scientific and/or philosophical retardation, enables us to ask which was the particular intellectual atmosphere that prompted Greek-speaking scholars to undertake the merging of the new natural philosophy with traditional metaphysics. This question brings us to the realization that Greek-speaking scholars had actually embarked on an enterprise described by Diderot in the *Encyclopédie*: Securing the unity and the continuation of philosophy, which were endangered by the proliferation of the philosophical interpretations of nature, was considered one of the greatest challenges for 18th-century European philosophy. And this leads to a second important realization. In the second half of the 18th century, Europe was still far from unified in rejecting traditional metaphysics, let alone in defining the proper meaning of *scientia* as an anti-metaphysical way of investigating nature (Patiniotis, 2011).

These examples illustrate a situation in European science quite different than the one implied by the received narrative. Science in Europe until well into the 19th century was far from homogeneous and even far from ‘European’ in the sense of a shared knowledge pattern. Trying to find their way in a highly diversified intellectual landscape, the scholars of the European periphery exploited their own philosophical and educational traditions in order to articulate highly local expressions of natural philosophical discourses. Unlocking these local discourses helps broaden our historiographical perspective and expose the diversity, which comes under the umbrella of ‘European science.’

To reiterate: History of science in the European periphery may significantly profit from the repudiation of the centre-periphery dichotomy incited by recent modernity studies and history of science in post-colonial context. With this repudiation in mind it is clear that historians cannot afford to account for the emergence of modern science from a privileged standpoint. They are rather invited to inquire into the political and cultural circumstances under which certain knowledge patterns gained epistemic authority in a variety of local contexts. Such an approach undoubtedly helps local historiographies

of science to disengage from the established diffusionist model. At the same time, though, this might also offer historians working in the European periphery the chance to contribute in a particularly productive way to the general discussion. By showing that the much-appreciated 'European science' was the unstable outcome of a continuous negotiation among various local knowledge patterns, they open up Europe itself to the methodological tools and the critical contemplations of post-colonial studies. This could offer a broader view not only over the conditions that governed knowledge exchanges between colonial societies and the imperial centres, but also over the shifting balance of epistemic power among various localities within the centre itself. This is a much-needed development, if history of science wishes to bear the label global.

4. Appropriation and Beyond

One important issue arising from the above discussion is how historians in the European periphery can articulate a historical methodology that will take advantage of the recent reorientations in the broader context of history of science.

Many historians today have come to understand that it does not make much sense to directly attack the centre-periphery dichotomy. It is especially fruitful, though, to show the limitations of the historiography that serves this dichotomy and how new questions can emerge if research follows different trajectories. In the context of this problematique the sciences are not perceived as closed systems of ideas and practices, which were unalterably established in different receiving environments, nor as self-contained enterprises of natural investigation, to which the various social circumstances simply served as incentives or disincentives. They are rather treated as cultural phenomena deeply affected by the civilizational patterns of each local context. This perspective helps historiography of science disengage from the positivist pattern of 'transfer' of scientific ideas and practices, and ask questions focusing on the processes through which new scientific ideas and practices were assimilated by intellectual environments significantly different than those where these ideas and practices originated. In this respect, the subject matter of historical inquiry should not be the investigation of the factors that favoured or prohibited the establishment of the 'original' scientific ideas in the periphery, but rather the study of the means employed by each receiving environment to incorporate the new ideas and practices into its established social, cultural and educational structures.

The notion of 'appropriation' is central to this approach. The purpose of a historiography built around the notion of appropriation is to articulate the particularities of the discourses that were developed and eventually adopted within the appropriating cultures, as a result of local scholars' active endeavour to incorporate new scientific ideas in their particular intellectual and social setting. This endeavour has to do with the fact that new ideas usually provide alternative methods and responses to questions to which peoples and cultures *already had adequate answers*. In other words, new ideas

and practices do not enter a void; they always displace other, usually strongly entrenched systems of thought and frameworks of practice. As a result, the assimilation of the new ideas could not be achieved without the formation of an appropriate legitimizing context.

Emphasis on appropriation encourages historians to stop dealing with making lists of ideas and practices, which were successfully transmitted to the various locations, and concentrate on the metamorphoses these ideas and practices underwent through the various stages of appropriation. This approach is further justified by the realization that the 'scientific centre' never really existed. In this respect, the scholars of the periphery were never asked to deal with a homogeneous set of established scientific ideas; they were rather prompted to select those ideas which better expressed their personal and/or communal predilections from a broad spectrum of scientific and philosophical views of nature. And the scientific discourses they eventually articulated were not poor reflections of an unequivocal conceptual and methodological framework, but original syntheses, informed by the cultural affinities and the philosophical priorities of their local intellectual context (Gavroglu et al., 2008, pp. 159–161).

True that, so far, only a few investigations have been produced along these lines. However, one especially interesting aspect of such contemplations from the perspective of this paper is that they bring history of science in the European periphery, once again, in a parallel trajectory with the developments in post-colonial studies. And, as it will be argued in what follows, this synchronization may significantly help both local history of science and the broader discipline to extend their research scopes and refine their historiographical tools.

The notion of appropriation has long been employed by post-colonial studies. Indeed, the first instance of this notion occurs in Basalla's three-stage model and it refers to what we could name 'reverse appropriation.' As already mentioned, according to Basalla's scheme, in the beginning of their relationship with modern science, the subaltern societies had a particularly productive role, *but not of their own*. They mostly functioned as providers of raw data, or of inspiration to the scientifically advanced societies of the centre. Thanks to their pre-existing scientific structures, the centres were in a position to absorb data from the periphery and subsequently organize, classify and transform them into 'proper' scientific expressions. According to a number of studies, this kind of appropriation proved crucial to the shaping of such disciplines as geology and botany, where the collection and comparison of specimens was of great importance, as well as of medicine, where practitioners were offered ample room for experimentation and opportunities for learning from indigenous medical traditions. Strange as it may sound — in the sense that historiography of science increasingly distanced itself from Basalla's model — this notion of appropriation retained until today a persistent influence on a significant number of works dealing with science and the Empire (Harrison, 2005, pp. 61–62; Safier, 2010, pp. 136–137). Gyan Prakash, for example, not only stressed the importance of appropriation of the Indian natural and human resources by mainstream British science, but also showed the inherently contradictory character of such a process,

to the extent that it also involved the transformation of the Indian elites into a privileged audience for the very sciences which racialized their society and objectified their natural environment (Prakash, 1992). More recently, Steven Harris, summarizing the Jesuit overseas missions, showed how the New World's *materia medica* was incorporated into the Old World's medical paradigm, stressing at the same time the importance of Jesuits' ideological predilections with regard to the ways the appropriated knowledge was aligned with the established medical knowledge of the centre (Harris, 2005, pp. 75 and 77).

However, as historians distanced themselves from Basalla's theoretical elaborations, they also favoured a different kind of appropriation, as a radical reaction to the predominance of the diffusionist model. The new historiographical context is built around the assumption that modern scientific ideas and practices were not passively received by the local actors in the periphery, as indicated by the *second* stage of Basalla's model, but they were creatively transformed by those actors according to the local cultural traditions. In the process of such a transformation new pieces of knowledge emerged, so that a local scientific discourse was gradually developed. A recent 'Focus' in *Isis* journal successfully summarized a number of case studies involving this approach. Darwin in 19th-century India served to 'reengage religion with science and also to *appropriate* and *domesticate* science as a dimension of Indian civilization' (Kapila, 2010, p. 129; emphasis is mine). In 19th-century Egypt, cognitive pursuits related to the broad and unspecified area of 'Western learning' were easily brought in line with religion and traditional natural philosophy, notwithstanding their highly technical character (Elshakry, 2010, p. 101). In China, Western presence, especially during the Opium War of 1849–1852, catalyzed the rearrangement of the local epistemic priorities.

> As in Egypt, this involved a broader process of *legitimation* and conceptual *appropriation*. Similar, too, was the way those new sciences classed under 'Western learning' were in fact initially regarded as reinforcing traditions and disciplines of knowledge for which Chinese scholars and pedagogues (. . .) created their own highly *local* genealogies' (Elshakry, 2010, p. 102; emphasis is mine).

Along similar lines Cañizares-Esguerra explains how, due to the local patriotism of the New World Creole elites, 'for every "imperial" version of a science that arrived in America a local, "colonial" version emerged.' In the context of the local 'middle kingdoms,' the epistemic and pragmatic goals of metropolitan expeditions turned into 'utopian patriotic narratives of the landscape and nature.' Thus, the assumed negative influence of the Southern Hemisphere stars on living organisms was transformed into a providential one, also challenging the European estimates of their size and number. And Linnaean botany upon its arrival in the 'tropics,' was appropriated by the local naturalists in a way that radically subverted its aim to unify and strengthen the imperial state (Cañizares-Esguerra, 2005, p. 69–70). The active appropriation of the imperial science by the local actors could sometimes be quite extreme as exemplified by the re-enchantment of science described by Prakash. Through the subalterns' 'third sight,' museum exhibits that were supposed to intimidate the illiterate Indians with the wonders

of science turned into pure wonders placing 'science and magic in a relationship of dangerous liminality' (Prakash, 1992, pp. 154–155 and 172–173).

'Local,' 'traditional' and 'active' are the adjectives; 'appropriation,' 'transformation' and 'domestication' are the nouns, all extensively used to register the *active* role of the (colonial) periphery in shaping modern science.[12]

> The more we examine the intricacies of colonial science, the more it seems to be characterized by 'multiple engagements,' both within and without individual colonies. Colonial scientific relationships no longer seem to resemble a wheel with metropolitan bodies or patrons at its hub, but what David Wade Chambers and Richard Gillespie have termed a 'polycentric communications network,' with multiple layers of authority and interaction. To recognize this is not to ignore the fact that science was woven into the fabric of colonialism but merely to acknowledge that its nature was not defined by colonialism alone. (Harrison, 2005, p. 63).

As shown above, historians of science in the European periphery have also looked to appropriation as a means to pursue their historiographical agenda and, on this front they intersect with the developments in post-colonial history of science. Neither the colonies nor European periphery resemble wheels with scientific metropoles at their hubs. In both cases local actors shaped the received views and practices in different and often unexpected ways in order to align them with their familiar intellectual patterns and cultural predispositions. This holds especially true for cultural milieu permeated by deeply entrenched and time-honoured intellectual traditions, which did not actually have any reason (*except maybe for military efficiency*) to submit to 'Western learning's' superiority. But what does it mean to reach such an acknowledgement? Using 'appropriation' instead of 'transfer' and the other concepts of the diffusionist model surely enables historians to fathom the mechanism under the 'multiple engagements.' It also hides a dangerous trap, however: If the periphery (colonial or European) had been actively appropriating instead of passively receiving, *what* did it appropriate - scientific ideas, technological innovations, instruments, practices, ontologies, representations, methodological choices? Whatever the way the periphery appropriated each (or all) of these categories, it would have remained subordinate to the originality of their conception in the centre. However actively the periphery transformed what it had appropriated, even to the extent to render it unrecognizable, it remains a fact that *the original* thing had been conceived in another location, marked as a *locus* of scientific or technological innovation (cf. Mitchell, 2000a, p. xii).

What these questions try to stress is that the use of appropriation is not enough for historiography of science to definitely disengage from the diffusionist model. As appropriation originated within this model, its systematic use may entail the possibility of reproducing diffusionist perceptions at a deeper level. Still, constructing a historiography based on the notion of appropriation may provide convincing answers to the deadlocks of the diffusionist view. The way to achieve this is not straightforward. It requires the notion of appropriation to be placed in the context of a broader historiographical enterprise, particularly one that gained significant impetus during the last decade.

5. From Local to Global . . . through the Periphery

'It may be that where you live, stones are not alive, (. . .) but here they grow and for that reason are living.' Some residents of the Acre community in Brazil, strongly believe that stones are living organisms. What is more important from the epistemological point of view, however, is that they do not assume that this holds true for every locality. It is a fact only as far as *their* knowledge can reach (Safier, 2010, p. 140). Human definitions and human interpretations of 'nature' as well as the attitudes of the individuals towards 'nature' may significantly differ across time and space (Roberts, 2009, p. 10). However, what has characterized most accounts of science since the Enlightenment is the claim of universality. Science was considered global by its very constitution and its moral authority over the various localities sprung exactly from its inherent universal validity. This auto-centric picture of science as a genuine expression of rationality and utilitarian efficiency naturally led to assigning an inferior significance to all other knowledge expressions that were deemed purely local, non-Western and lacking universal span (Mitchell, 2000a, p. xi; Schaffer, 2009; Safier, 2010, p. 140).

The point is, however, that science in history has always been a highly local phenomenon. In the beginning (if one is allowed to use such a language) there was no such thing as science. There were practices, instruments, methods and the ensuing knowledge attainment; and there were, of course, the underlying epistemic values and priorities. But all these were highly local and in most cases they had to make a special effort to cross the boundaries of their particular cultural and intellectual context (for an especially illuminating example concerning Newton's prisms, see Schaffer, 1989). The increasing focus of recent historiography on the situated and micro-historical has turned the assumed universal value and global applicability of science 'from premise to puzzle' (Schaffer, 2009):

> In this postpositivist view, then, science is locally created, and only subsequently, through a series of investments and deliberate strategies, does it become transferable to the outside world. Some scholars have identified these investments and strategies in the standardization of methods and measurement, others in rendering the new knowledge immutable, while for yet others it is negotiability or open-endedness that are inherent properties of the knowledge, practice or device that seeks to impose itself in the outside world. In consequence, the primacy of universality over locality has been reversed: the question of science's claim to universality (. . .) has been reformulated and has itself become an object of historical, social and political inquiry (Raj, 2010, p. 514; see also Raj, 2007, pp. 8–9).

This is a relatively new intellectual landscape in historiography of science. Although the turn to micro-history has been developing over several decades, the realization of this reverse ('from premise to puzzle') occurred only in the last few years. Micro-studies enabled historiography of science to bring forth all those stories of local production, adaptation and appropriation, which problematized the received universality of science. But up to that point, they contributed to documenting the local character of scientific attainments and to depicting science as 'a continuous path whose formative trajectory

is constituted out of multiple points of local contact and exchange.' (Roberts, 2009, pp. 17–18). It needed an additional challenge to bring this problematique into the quarter of the global: However local the origin of the various scientific attainments, their validity seems to extend far beyond the places they originated. No matter how hard (or, actually, how snobbishly) Newton struggled to legitimize the outcome of his prism experiment, today we all see the same seven colours as a result of the white light analysis. No matter how perplexed and locally determined the discovery of oxygen by Lavoisier, today chemistry is an oxygen-based chemistry all over the world. Scientific ontologies, methods and measurements have gained an indisputable global currency. Thus, 'the challenge to historians of science before science became "pre-packaged" is to explain how *local knowledge* — for contextualized knowledge is always rooted in a particular place and time — became *universal science*, that is, how context eventually erased itself' (Daston, 2009, pp. 807–808; emphasis is mine; see, also, Roberts, 2009, p. 14).

This is the ground upon which 'appropriation' as a historiographical tool for the study of the active role of peripheral scholars may acquire a broader and more dynamic meaning. Scientific attainments, methods, ontologies and practices had always been local and each one of them was shaped (although never definitely) through the circulation across regions and points of exchange. But to answer the question of how science came to be universal we need to take one more step. Extending Arjun Appadurai's thought, if the *genealogy* of the sciences is about their circulation across regions, the *history* of the sciences is about their on-going domestication into local practices and attitudes (Appadurai, 1996, p. 17). The universality of science was not, thus, the direct outcome of the self-evident epistemic superiority of a number of collaborative knowledge attainments, which, in the course of time, came naturally together to make up the body of modern science. The universality of science is an *added value*, also gained through the circulation of ideas and practices across localities. A historiography built around the notion of appropriation can persuasively account for this process, as it stands at the intersection of the 'uneven, diverse, and contingent' flows of historical and genealogical forms. Appropriation is not about how an active and unintimidated periphery stood before the scientific attainments of other, intellectually more powerful localities. Neither is it only, or predominantly about the production of local versions of scientific discourses, which were subsequently more or less successfully incorporated into the body of universal science. It is something considerably broader. The apparent answer to the question 'appropriation of what?', asked in the previous section, is: 'appropriation of another locality *which, for the most part, was still local*.' But, in light of the above considerations, we could now add the following assumption: Every performance of appropriation, due precisely to the different 'speeds' in which knowledge and cultural forms move across geographical and cultural boundaries, tends to produce a legitimizing context, which transcends each one of the involved localities. In this sense, employing the notion of appropriation enables historians to study *the globalization of science as a*

localizing process. Appropriation, after all, is about how the universality of science was staged at the periphery.

As noted earlier, the notion of appropriation has been extensively employed by the historiography of science in the periphery — be it a colonial, or a European periphery. However, and despite historians' intention to overcome Basalla's scheme, the way it has been applied in a number of studies tends to reproduce the basic premises of the diffusionist model. But if, in accordance with the above considerations, we place the notion of appropriation in the broader context of the inquiry about the globalization of knowledge, then appropriation can acquire a different and much more instrumental role in the historiography of science. By focusing on appropriation rather than on discovery and innovation (the favourite categories of much of mainstream historiography), or on transfer and adaptation (the favourite categories of the diffusionist model), historians of science may bring to the forefront the re-inventions, the conceptual shifts and the cultural adjustments, which are responsible for the emergence of science as a global phenomenon in the periphery (cf. Roberts, 2009, pp. 24–25 and Sivasundaram, 2010b, pp. 154–155).

6. *Conclusion*

This paper was motivated by a question, which became relevant due to recent developments in the European historiography of science: How could history of science in the European periphery fruitfully mesh with science history in post-colonial context? Beyond simple comparisons and despite pinning down similarities and discrepancies, it aimed at investigating the mutual benefits that could be found at a deeper level. Are the two historiographies relevant to each other and to what extent does their intersection provide ideas, methods, categories and problems which may creatively affect their respective research agendas? The suggested answer is composed of two interrelated contentions.

In the first part of the paper, the critical reassessment of the centre-periphery dichotomy took advantage of the post-colonial critique of the notions of 'Western' and 'European.' At the same time, the limits of this critique were indicated — especially concerning science — and a further disengagement from the stereotype of 'European science' was suggested by means of an intra-European decomposition of the notion of scientific centre: Studying the history of science from the standpoint of the European periphery enables historians to unveil the diverging nature of a number of intellectual undertakings, testifying thus to the unstable and multifarious character of an assumedly homogeneous European science. As a result, a research area can be drawn, where the analytical categories of the history of science in post-colonial context can be productively combined with those of the history of science in the European periphery to broaden the scope and extend the interpretative reach of both fields.

The second part of the paper was concerned with the historiographical tool of 'appropriation,' which has been increasingly employed by historians to study the sciences

both in the European and the colonial periphery. An attempt was made to radically disengage the specific notion from its implicit diffusionist connotations. Particularly helpful to this end was opening the discussion to historical inquiries exploring the processes, which assigned universal validity to locally originating scientific attainments. This perspective indicates that appropriation should not be confined to recording the epistemically active stance of the local actors towards the scientific attainments of the centre. A historiography built around the notion of appropriation should primarily aim at showing how the globalization of the sciences took place in the periphery as a result of the legitimizing processes, which were activated by the encounter of different localities.

Interestingly, the application of this approach to the European periphery seems to be especially pertinent to the research area defined by the intersection of history of science in the European periphery with history of science in post-colonial context. If one *purpose* of such a joint venture is to subvert the notion of a geographic centre from which an inherently true set of scientific ideas and practices was spread to the rest of the world, one *means* to achieve this goal is to employ appropriation in order to investigate the particular historical circumstances, which enabled certain knowledge patterns to gain universal epistemic authority *as constitutive elements of an imagined European intellectual identity*.

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NOTES

1. It is apparently impossible to *define* post-colonial studies, especially taking into account that even scholars working in the area have significantly different perceptions. However, there are some basic features that give the term a certain consistency, which may adequately serve the purposes of this paper. In this respect, post-colonial studies are taken to denote an inter-disciplinary field where a variety of perspectives and methodologies converge to critically reassess the dominant colonial discourses of the past. Bringing forward the cultural dynamism of the colonized peoples, they point

to the actual hybridization that occurred during the colonial imposition. Additionally, they aim to give voice to the long silenced local actors and show how by 'writing back' to the metropolitan centres they challenge the established Western ways of thinking. Furthermore, post-colonial studies involve issues of identity, evident in the attempts of various authors to reclaim their national or cultural awareness from colonizers' discourses. Finally, and most pertinently for this paper, they address matters of knowledge production, examining how knowledge about the world and the self was generated in the context of a shifting balance of power between the colonizers and the colonized and was eventually legitimized in the service of imperial interests.

2. Another such initiative, also established in 1999, is 'Tensions of Europe.' It consists of an expanded network of historians from Europe and the USA, who aim at exploring transnational European history with a focus on the roles of technology as forces of change (www.tensionsofeurope.eu). Their main tenet is that examining the European integration through the lens of technology will make visible a bottom-up 'hidden integration' and provide a deeper and richer historical understanding of the process. For an early discussion of the scope and the historiographical perspective of the group, see Misa and Schot (2005). See, also,Van der Vleuten and Kaijser (2006), Schot (2007) and Van der Vleuten (2008).
3. From the programmatic declaration of STEP published on an earlier version of its web page (www.uoa.gr/step). Now available by the author.
4. See, indicatively: Schiebinger (2005), Cañizares-Esguerra (2006), Raj (2007), Delbourgo (2008), Roberts (2009), Schaffer et al. (2009), Terall and Raj (2010) and Sivasundaram (2010a).
5. Typical studies of the kind: Cipolla (1970), Navarro (1976), Brockway (1979), Headrick (1981), Turshen (1984), Adas (1989) and Gascoigne (1998).
6. For the role of national historiographies of science in the construction of the image of glorious but underrated periphery, see the special issue of *Nuncius*, 23 (Homburg, 2008; Kılınç, 2008; Nieto-Galan, 2008; Patiniotis, 2008; Simões, Carneiro and Diogo, 2008). For literal claims of this kind, see, most characteristically, the program of the fourth International Conference of the European Society for the History of Science, Barcelona 18–20 November 2010.
7. Δημαράς (2006, p. 6); originally published in 1968; translation and emphasis are mine; see also, in the same, p. 9.
8. Simões, Carneiro and Diogo, 2003; Bertomeu Sánchez et al, 2006; Simon and Herran, 2008; Papanelopoulou, Nieto-Galan and Perdiguero, 2009.
9. Cf. Kapila, 2010, p. 126 (emphasis is mine): 'While it is stating the obvious, it is nevertheless pertinent to remind ourselves here that the long nineteenth century was the British imperial century, with India as its centerpiece. Arguably, in the first instance, *Britain was made complete by India*. At the economic level, historians such as Adam Tooze have recently argued that modern economies were continental in scale and imagination, thus fuelling imperial competition. To extend Tooze, a small island state such as *Britain "needed" India to make a continental empire — economically, conceptually, and, indeed, scientifically*'.
10. See, for example, Gyan Prakash's classical study about the function of museums in colonial India. Taking a standing on the periphery may reveal aspects of 'European' or 'Western' science, which were not immediately visible in the centre (Prakash, 1992, pp. 172–173). Cf. his insightful note: 'Museums in India could be better organized to perform these scientific functions, it was believed, than in Europe, "where museums had grown up by accretion of legacies and bequests generally tied up with special conditions"' (p. 174).
11. See, for example, Elshakry (2010). About the (welcome) disrupting consequences of the view from the periphery see Mitchell (2000b, p. 24).
12. Cf., also, the negative form: '"inappropriate" reception of science, drawing on "improper" mixtures of objectivity and wonder' in Prakash (1992, pp. 154–155).

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