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Zombie projects, negative networks, and multigenerational science: The temporality of the International Map of the World

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Abstract

The International Map of the World was a hugely ambitious scheme to create standardized maps of the entire world. It was first proposed in 1891 and remained a going concern until 1986. Over the course of the project's official life, nearly every country in the world took part, and map sheets were published showing all but a few areas of the planet. But the project ended quite unceremoniously, repudiated by cartographers and mapping institutions alike, and it is now remembered as a 'sad story' of network failure. How can we evaluate this kind of sprawling, multigenerational project? In order to move beyond practitioners' (and historians') habit of summarizing the entire endeavor using the blunt categories of success and failure, I propose a more temporally aware reading, one that both disaggregates the (persistent) *project* from the (always changing) *network* and sees project and network as invertible, with the possibility of *zombie projects* and *negative networks* that can remain robust even when disconnected from their original goals. I therefore see the abandonment of the International Map of the World as resulting from vigorous collaboration and new norms in cartography, not from lack of cooperation or other resources. New categories are required for analyzing science over the long durée.

Keywords

cartography, infrastructure, International Map of the World, mapping, multigenerational science, networks, zombies

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Persistence, mortality, and 20th-century mapping

One of the payoffs of tracing technoscientific networks is that the boundaries between people, practices, and artifacts become noticeably blurred. Hierarchies are collapsed and new kinds of agents become important. The more recent analytic interest in infrastructure goes even further, adding not just shared physical resources but also shared classifications, standards, and norms as the necessary bedrock of networking in general. Claims to scientific stability and universality are revealed as fragile, local, and situated, while familiar dichotomies – between technical and political, human and non-human – are flattened (Bowker and Star, 1996; Latour, 1986; Rankin, 2009; Timmermans and Berg, 1997). But understanding science through its networks and infrastructures often implies a temporal flattening as well: these are fundamentally spatial metaphors, and a rigorous methodological symmetry between heterogeneous actants can easily overlook the mortality of human lives. This is especially problematic when trying to understand the sprawling global networks of the past hundred years, where a single project can connect not just a variety of resources and constituencies but also multiple generations of practitioners, each with a different sense of how to do science and of the kind of science worth doing.

The map in figure 1 presents this dilemma in microcosm. It was created in 1927 by the US Geological Survey, and it shows the topography, cities, roads, and boundaries of the Hudson River valley with a standardized palette of lines, colors, and typefaces. It was published as part of a huge collaborative effort known as the International Map of the World (IMW), the goal of which was to produce similar maps for the entire world. The hope was that these simple graphics would not just present the particularities of this small slice of the United States, but that they would also enable quick and trustworthy comparison with other regions as well. As explained by a British geographer in 1913, 'every sheet [is] written in the same language, without difference even of local idiom, so that who[ever] learns to read one sheet may read them all'. The result, he predicted, would be nothing less than a 'new era in cartography' – one of universal communication across both time and space (Hinks, 1913: 78).

The IMW was one of the central touchstones of 20th-century cartography, and it offers important insights into both the coagulation and the disintegration of scientific cooperation. It was first proposed in 1891 at the International Geographical Congress in Berne, when the young German geomorphologist Albrecht Penck suggested that an ambitious program of coordinated maps finally would allow the consolidation of all existing geographical knowledge and set a course for future work, thus helping to pivot the study of geography from the heroism of 'breakthrough discoveries' to the more properly scientific task of 'filling in the holes' (Penck, 1892: 191–192). By the eve of World War I, the project's specifications had been given the force of international treaty, and, as shown in figure 2, nearly every country in the world had officially agreed to participate. Over the next several decades, hundreds of sheets were published by dozens of mapping agencies, and the same graphics were used as a template for various national map series as well. During the Cold War, the project was coordinated by the United Nations, cartographers assembled by the hundreds to discuss its progress, and coverage was almost complete by the 1980s. Figure 3 shows this quite dramatically: At that time, only Greenland, Antarctica, and parts of southern Africa remained unrepresented. Not only

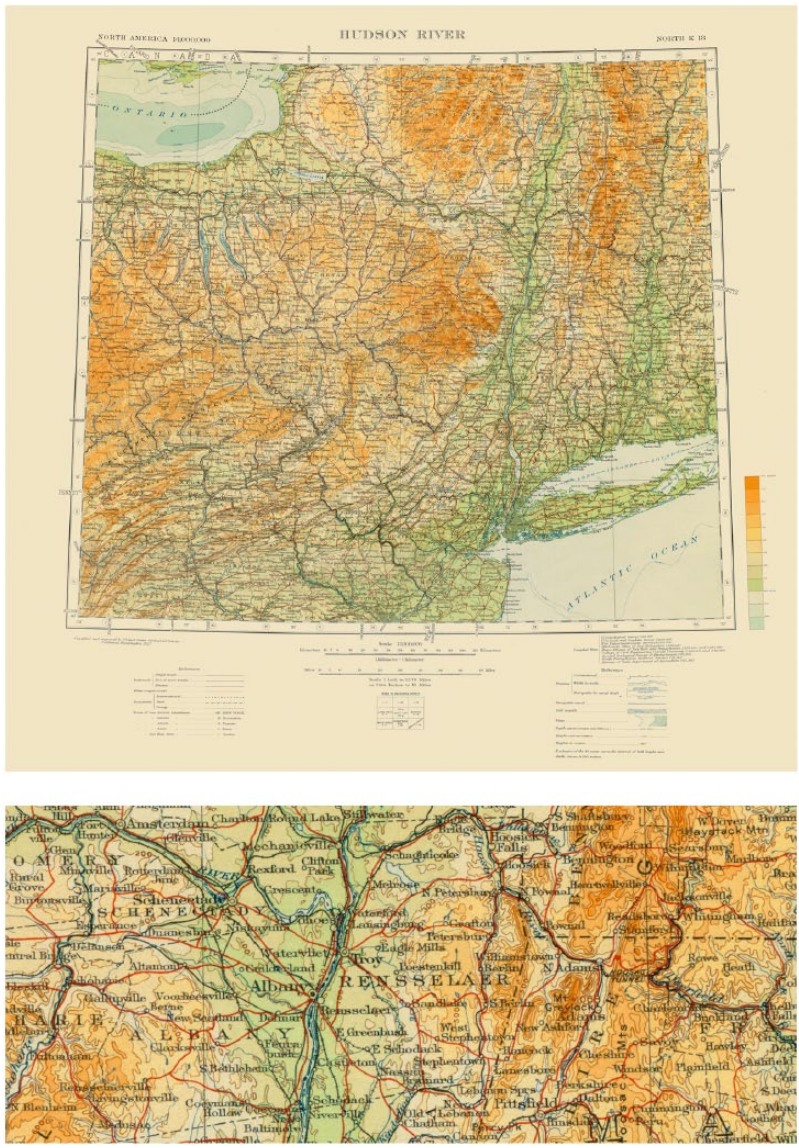

Figure 1. Sheet of the International Map of the World, *Hudson River*, published in 1927 by the US Geological Survey. Detail of the Albany area is shown at actual size.

did the IMW network outlast its original founders – and even many of its sponsoring governments – but it also weathered two world wars, the global sweep of decolonization, and the transformation of mapmaking from an artisanal craft to a mass-production process.

Figure 2. Countries adhering to the International Map of the World framework as of December 1913. After World War I, nine countries dropped out, including the USSR, Mexico, and Brazil. However, fourteen new countries joined, including ten that had not existed before the war.

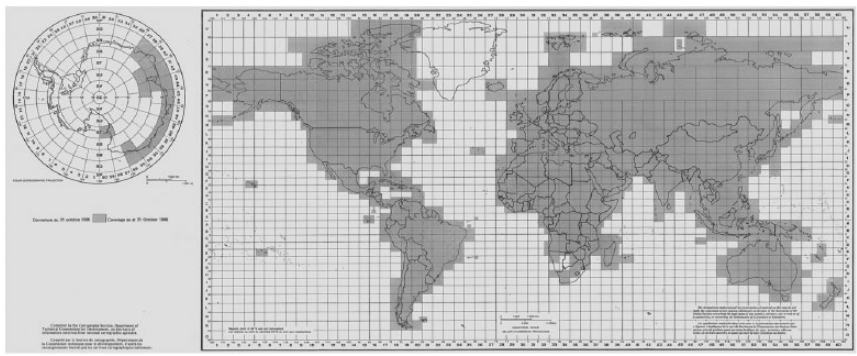

Figure 3. Index map showing coverage of the International Map of the World as of 1986. Except for Greenland, Antarctica, and five sheets in southern Africa, maps were available for all major land areas of the world. In addition, much of the coverage of the 800+ maps shown here was duplicated by overlapping and irregular sheets. From 'Status of publication of IMW sheets as at 31 December 1986', UN Document ST/ESA/SER.D/17, Supplement #3 (February 1987).

The IMW is thus an exemplar of both a heterogeneous scientific network – or rather, a network of networks, connecting everything from individual scientists and large institutions to the details of surveying instruments and printing techniques – and a disciplinary infrastructure project focused on standards, norms, and shared assumptions of legibility. It also concretized the epistemology, subjectivity, and politics of Euro-American mapping in ways that should be familiar to science-studies scholars and

critical geographers alike; it was a strategy of spatial power that was meant to reduce the messy complexity of the world to a single authoritative image (Edney, 1993; Harley, 1989; Latour, 1986; Scott, 1998; Turnbull, 1993).

Today, however, the IMW is mostly remembered as a cautionary tale about nationalist rivalry, scientific hubris, and obsolescence. In 1986, rather than celebrating the imminent completion of the project, a panel of experts instead advised the UN to withdraw its support entirely, having determined that 'the concept of the International Map of the World … appears to be no longer appropriate or feasible' (UN Ad Hoc Group of Experts, 1992: 42). Despite ongoing production, criticism of the IMW had in fact been mounting since the 1960s, and by the mid-1970s, it had become 'fashionable' to disparage its basic premise (Gardiner, 1974: 162). Almost without exception, pundits looking back from the early 21st century have regarded the IMW as a 'failed' project, its history a 'sad story' of the pitfalls of epistemic overreach and naive internationalism (Rhind, 2000: 299; also Pearson et al., 2006). In this reading, the successful (if inconsistent) publication of hundreds of maps is overshadowed by the eventual unraveling of the network.

But my reading of this final phase is rather different, and I want to use it to raise new questions about the temporality of the project in general. I argue that the IMW did not come to an end because the network faltered or because the task of creating standardized maps proved to be unworkably difficult. Instead, the very goal of standardization became seen as a misguided perversion of the true goals of cartography, as mapmakers came to prioritize specific local tasks over universal geographic knowledge. I therefore see the abandonment of the project as itself the result of a robust scientific collaboration and its alleged failure as only the last of a series of historically situated successes – and one that was actually not as final as it might at first appear.

This assessment relies on two analytic interventions, both with broader implications. First, rather than evaluating the IMW as a unified whole, using categories such as success and failure, rise and fall, or life and afterlife, I have found it necessary to disaggregate the *project* from the *network*, to see both as plural rather than singular and to investigate their differing temporal statuses and, in Bruno Latour's recent terminology, their conditions of felicity (Latour, 2013). The project is about production; it is defined by specifications (either textual or visual) that call forth specific objects and subjectivities. A project can thus endure relatively unchanged even as its original creators lose interest or control. The network, in contrast, relies on an ongoing exchange (both intellectual and material) between living, breathing humans. The network is not exclusively human – not by any means! – but it must always be evolving, since humans age and die and are subject to the ruptures of war, restricted mobility, and changing disciplinary assumptions. Investigating the historicity of networks and standards is hardly a new problem (Hughes, 1983; Radin, 2014; Timmermans and Berg, 1997), but it is not enough to say that networks change over time. Instead, megaprojects like the IMW must be understood as a constant interaction between persistence and mortality.

My second intervention is about how projects and networks interact and what happens when they diverge. When a celebrated and vibrant project becomes untethered from the network that originally created it, it can transform into what I call a *zombie project*, with production being continued for new purposes by different groups. Networks can likewise

continue without shared commitment to a project, with a *negative network* of acrimony, criticism, and active opposition remaining quite robust even as production splinters. In both cases, a binary and often anachronistic choice between success and failure is thus replaced by an analysis of modalities – alive and undead, positive and negative – that are productive even when inverted. And historically, these inversions can have rather dramatic effects. Later generations can redefine a project or a network to the point that a fundamental continuity appears instead as a radical rupture. Even the very core of a project – its basic standardizing impulse, for example – can come to be widely contested (or outright rejected), and yet both physical and intellectual production might never be interrupted. The opposite is also possible: Continuities of rhetoric or institutional support can mask major changes in shared meaning and output. This new vocabulary thus allows the multidecade history of a project like the IMW to be told without using the goals of its founders (or its inheritors) as the only basis for evaluation.

Over the course of the twentieth century, the IMW network can be periodized into four distinct generations of practitioners, each lasting roughly twenty-five years and separated by major world events. Each generation sought to align the IMW with its own assumptions about the goals of cartography and its own measures of success, and in each phase map production was sponsored by different institutions for different reasons. The basic act of networking also took many forms: international meetings of national officials in major cities, scholarly discussion (both collegial and combative) published in journals large and small, a central clearinghouse for cataloging and evaluating finished maps from around the world, and a steady succession of regional meetings organized under the post-war banner of economic development. This constant shifting resulted in two main iterations of the IMW as a well-defined project: one was codified just before World War I, the other in the early 1960s. The debate surrounding the second version is what eventually led to the dissolution of the project.

The two sections of this article trace the transitions between these successive generations of the network and the two iterations of the project. My goal is to show how the same set of specifications could be used for different ends and how the meaning and goals of the project could change even as the maps themselves remained relatively unchanged. There is a similar dynamic in both sections, where a momentary alignment between a positive network and a living project is then followed by the inversion of both. In the first section, from the 1890s to the 1930s, the IMW moves from its beginnings in geographic scholarship and inconsistent national support to become a thoroughly official meditation on sovereignty and civilization, but one that was largely hijacked by private mapping societies. In the second section, from World War II through the 1970s, it then moves from being seen as a powerful epistemological diagram incongruously sponsored by Allied militaries to being reconceived as a tool of international development assistance to be pursued without collaboration by individual countries for their own purposes. I analyze the broader implications of the IMW for cartography and territoriality elsewhere (Rankin, 2016); I therefore end the article by highlighting the persistence of zombie production and negative networking into the present and offering some concluding thoughts about the longevity and mutation of scientific networks.

My account of networks, infrastructure, and failure thus differs from other work in science studies in two main ways. First, in contrast both to classic work like Latour's

analysis of Aramis, the aborted Parisian mass-transit system, and to more recent work on infrastructural maintenance and repair, my analysis is not framed around a battle between presence and absence – or between the worthwhile and the marginal – and I treat the oscillation between life, undeath, positivity, and negativity as part of the normal course of mainstream technoscience (Latour, 1996; Sims and Henke, 2012; Ureta, 2014). But the more important difference is that I do not focus on the level of the event – a specific cancellation, controversy, or act of suppression. I want to understand historical change in the longer durée, at the scale of decades rather than months or years. In the long run, scientific networks do not break, and infrastructures do not crumble. Instead they transmogrify.

From collaborative to competitive

When Penck first proposed his project, his goals were primarily directed toward the scientific study of geography. He justified the project as a way to pursue comparative research into landforms and landscapes around the world, a task that he argued required a 'unified representation' of the earth – a single, trustworthy map that could provide a 'secure foundation' for study and gradually be perfected over time (Penck, 1892: 192, 198). Penck and his supporters likewise framed the project as a way for geography to hold its own among academic disciplines – especially astronomy, geodesy, and geology – and its ambitious scope was seen as a direct riposte both to the geologists' ongoing work on a unified geological map of Europe and to the astronomers' expansive *Carte du ciel* (Penck, 1901: 65). But as popular as this vision was, it was relatively short on specifics and did not prove especially effective at provoking new mapping. The project only started to attract serious patronage once it was subsequently adopted by interested officials at national survey agencies, who tended to focus much more closely on the details of cartography and saw proper international mapping as the right and responsibility of rivalrous sovereign states.

In other words, in the early twentieth century the IMW moved from being an inchoate plan by geographers for improving scientific geography to a formal project spearheaded by mapping officials and non-academic cartographers, where representation took on a dual character, simultaneously scientific and political. This was the first generational transition of the network, and it ended with the first codification of the project as a formal set of international standards. Almost immediately after the final specifications were signed in 1913, however, World War I and its aftermath saw the forceful emergence of several kinds of unsanctioned mapping – some quasi-official, some fully undead – and the IMW network quickly became as much about critique as cooperation. Despite the stability of the standards, nearly everything about the network turned over – the human participants, the goals (both epistemic and political), the tenor of debate, and even its international character – and the project came to be pursued in a piecemeal, fragmented, and often confrontational fashion. But still the maps continued to be produced.

For the initial generation, international collaboration was seen foremost as coordination problem among scientists, not states, and the hope was that only a few simple standards would provide an organizing framework for long-term work. In his 1891 presentation, Penck mentioned several possibilities – including final agreement on the metric system,

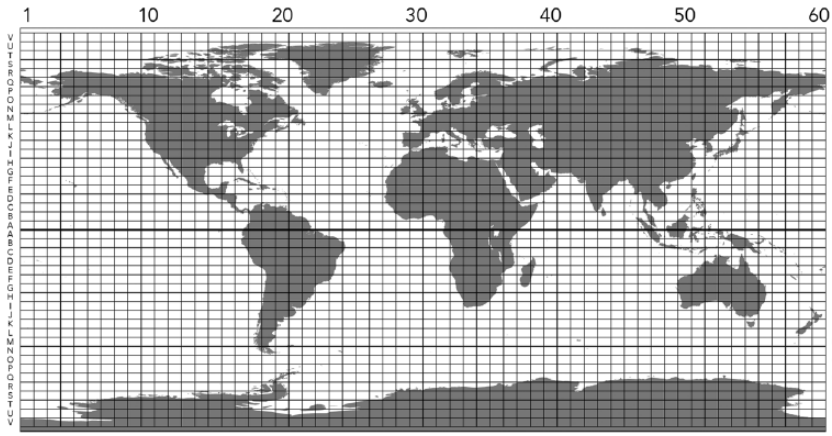

Figure 4. Regulating grid for sheets of the International Map. Each sheet is 4° × 6°; there are 2642 sheets in total, but only about 900 that show major land areas. This grid is also used for reference: Columns are numbered west to east from 1 to 60, and rows are lettered away from the equator from A to V. The Hudson River map in Figure 1 is therefore sheet 'North K-18'. Tasmania is 'South K-55'. Note, however, that the final collection of maps could not all be fit together as shown here, since each map was drawn using its own individual projection (notice the non-rectangular border in figure 1). The only way to assemble multiple sheets would be as part of an enormous globe, more than forty feet in diameter.

the Greenwich meridian, and the Latin alphabet – but he focused most of his energy on two basic parameters of the map sheets themselves. By far the most important was the scale of the map. Penck proposed a scale of 1:1,000,000 (about 16 miles to an inch), which he saw as a perfect intermediate scale – the missing link between the generalized maps found in atlases and the detailed work of national surveys. The other important point of coordination was a scheme for subdividing the world using a rigid gridiron of latitude and longitude that would ignore both national and physical boundaries. The final grid is shown in Figure 4, with each sheet 6° wide and 4° tall (Brückner, 1896: 373–374; Penck, 1901: 210). Both of these proposals gained widespread support – not just in Europe, but even as far away as Japan and Venezuela – as they promised to eliminate wasteful overlap and frustrating incompatibility. But soon enough it became clear that scholarly enthusiasm alone would not be enough to spur any actual mapmaking. As one of Penck's critics put it in 1899, a traveling conference series like the Geographical Congress had essentially 'no power' and was entirely unable to address the 'financial side of the question' (Wagner, 1901: 210).

Several of Penck's supporters, however, held positions in state mapping agencies, both military and civilian, and they saw standardized international mapping as a potential boon not just for scientific geography but also for their own budgets and prestige. The first step was taken by the chief of cartography for the French army, who in 1900 published a series of Penck-inspired maps of various warzones in Asia and the Americas. This mapping gave French cartography – and the Paris meridian – a dual scientific and

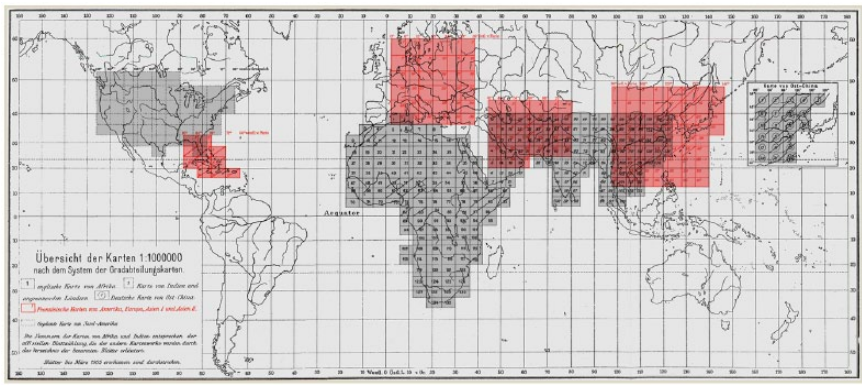

Figure 5. Various 1:1,000,000 mapping projects as of 1905, most of which were initiated for military purposes and did not align with Penck's original grid. French maps are shown in pink; other shaded areas show US plans for North America, British maps for Africa and Asia, and German maps of China and Korea (inset). Note that only sheets with a diagonal mark had actually been published by 1905 (from Penck, 1905a, shading added).

military publicity that was immediately interpreted as an international provocation. Figure 5 shows the response from the United States, United Kingdom, and Germany through 1905; together these countries proposed to publish more than three hundred 1:1,000,000 maps. Russia soon followed with plans for its own empire (Penck, 1905b: 553, 1909: 332, 335). The slow emergence of a transnational network and a unified megaproject thus relied on the frictions between disconnected national groups and the initial splintering of sub-projects. There is no originary wholeness here.

Within a few years, these same survey officials used the proliferation of independent mapping efforts as justification for much tighter coordination. An official conference was convened in London in 1909 that brought together more than a dozen agencies from Europe and North America, and in 1913 a second conference in Paris attracted delegates from thirty-four countries from around the world. These meetings resulted in a level of formalization that far exceeded anything that Penck himself had envisaged. Most obviously, they called for an unprecedented level of cartographic standardization; figure 6, for example, shows the dozens of seemingly minor symbols, colors, and typefaces agreed upon in 1913. Practicing mapmakers framed these standards not just as a way of ensuring that the IMW would be visually uniform throughout the world, but also entirely scientific and trustworthy, since the standards were the product of vigorous international debate. At the same time, the sponsorship of the map also became explicitly political, and it was agreed that each country – or at least each 'civilized' country 'with a suitable cartographical establishment' – should be expected to produce maps of its own territory. In the case of Africa, responsibility for map sheets was even subjected to formal negotiation between the metropolitan powers, as shown in figure 7 (International Map Committee, 1914: 20, 71). This simultaneous push for cartographic and political rigor was hardly coincidental. After the first conference, for example, one of the French delegates pitched the project to government officials at home by arguing

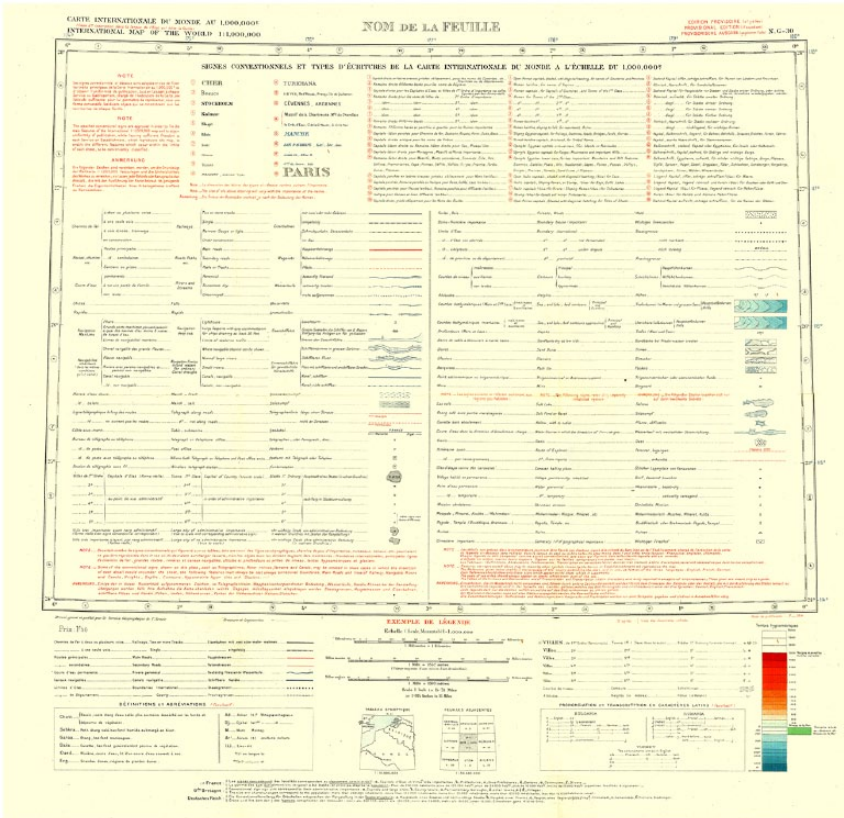

Figure 6. Conventional signs and marginalia approved at the 1913 meeting in Paris; international uniformity required legislating even the smallest details. Published in International Map Committee (1914).

that a standardized international map, 'homogeneous in conception and execution', would inevitably carry some 'official authority'. In response, the minister of public instruction agreed that it would, 'without doubt, be consulted in diplomatic negotiations'; the minister of war was likewise convinced that it would 'safeguard our dignity and our interests' (Brun, 1910; Doumergue, 1910; Vidal de la Blache, 1909). Scientific cartography and political autonomy each reinforced the other.

In other words, in the twenty years before any formal standardization, both the network and the as-yet-uncodified project evolved together. The original idea was that an international map would be reliable because its *content* would inevitably be vetted, cross-checked, and stabilized by a collaboration of trustworthy scientists. For Penck, neither the cartographic details of the map nor its sources of sponsorship were all that important. But as the leadership of the project shifted from academic geographers to state, military, and commercial mapmakers, these issues came to be seen as central to the

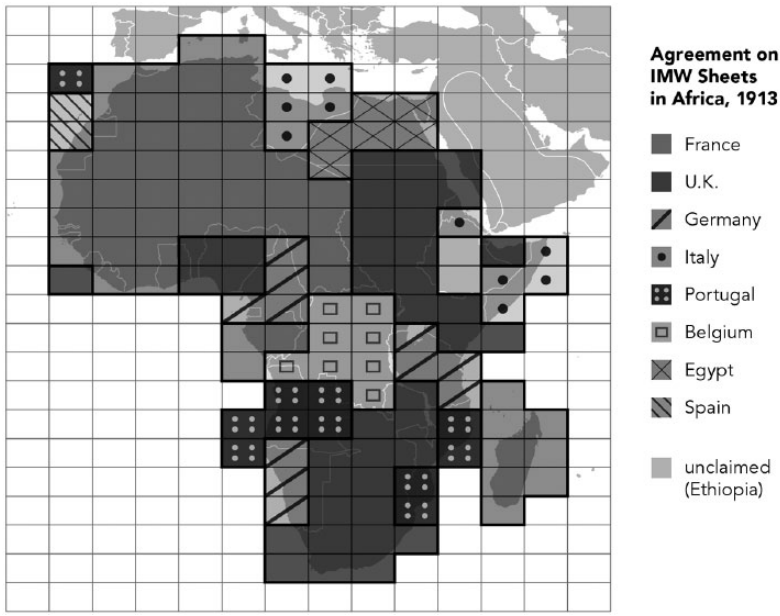

Figure 7. The cartographic partition of Africa in 1913, with mapping responsibility roughly following colonial control. Note that although Egypt would not gain political independence from the United Kingdom until 1922, it had its own mapping office and budget separate from the metropole. After these assignments had been made, Italy volunteered to publish the two unclaimed maps of Ethiopia as well – an offer that was received as a 'gracious proposition' by the French hosts. This map is based on *Carte du Monde au Millionième* (International Map Committee, 1914: plate 3; quote on 73).

project's success, and by 1913, reliable content was hardly discussed at all. Instead, the main concern shifted squarely to reliable *representation* – again, in both a visual and political sense. These two visions were hardly incompatible, but they were rooted in very different ideas of the project's methods, goals, and audiences.

Not surprisingly, as the IMW network continued to mutate (and sometimes splinter) over the next few decades, mapmaking that followed the IMW's graphic guidelines did not always follow the careful politics of 1913. Maps were made, but zombie projects proliferated. Not only did World War I cause a serious break in the formal life of the network and trump any immediate plans to publish maps for an international audience, but even after the network was formally reconstituted in the early 1920s, more than half of the roughly five hundred maps produced before 1939 ended up being published by private organizations rather than national survey agencies. In addition, most of these unofficial maps spread well beyond the territorial limits of the mapmakers' home countries. Figures 8 and 9 show this stark contrast between legitimate and illegitimate mapping: during the war itself, the British Royal Geographical Society produced maps of all of Europe, and in the 1920s and 1930s the American Geographical Society published

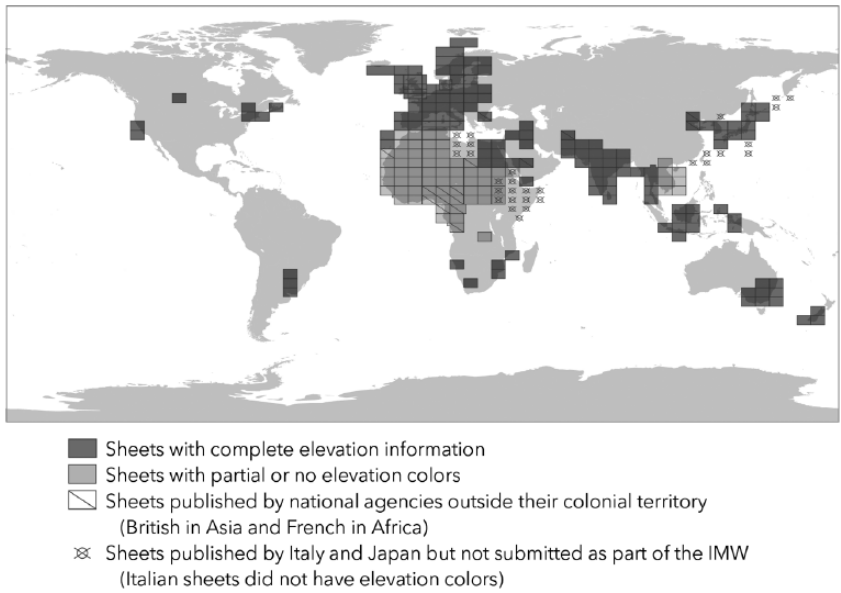

Figure 8. Official IMW sheets published before 1939. Fourteen sheets were published before World War I; the rest appeared steadily during the 1920s and 1930s. Of the more than 200 maps shown here, only fifteen violated the ideal of national self-representation.

maps of all of Latin America, the Engineering Society of Rio de Janiero upstaged the official mapping of the Brazilian government, and the Swedish geographer Sven Hedin started work on a huge block of central and eastern Asia. Likewise, Italy and Japan published additional maps that were not included in any official tallies, and the USSR – which had formally abandoned the project – published dozens of IMW-style maps without giving international notice at all. The network entered a negative mode of lively internal disagreement, and undead maps appeared everywhere from Kamchatka to Patagonia.

For most observers at the time, this proliferation of illicit mapping was the cause for some serious hand-wringing, and later writers have seen it as the earliest evidence of the project's overall failure. For example, in 1921 the famous German cartographer Max Eckert described the British maps as having a 'national tinge' that caused German and Austrian efforts to 'suffer'. The leader of the British project – the arch-nationalist geographer Arthur Hinks – in turn described the American effort as a 'pirate series … undertaken in cold blood' and wagered that if its leader, the equally nationalist American Isaiah Bowman, had 'formally asked authority to produce the sheets … it could not have been granted' (Eckert, 1921: 112; Hinks, 1923: 369, 370). For skeptics of optimistic internationalism and Wilsonian self-determination, the track record of the IMW provides more than enough evidence of broken promises and backdoor imperialism.

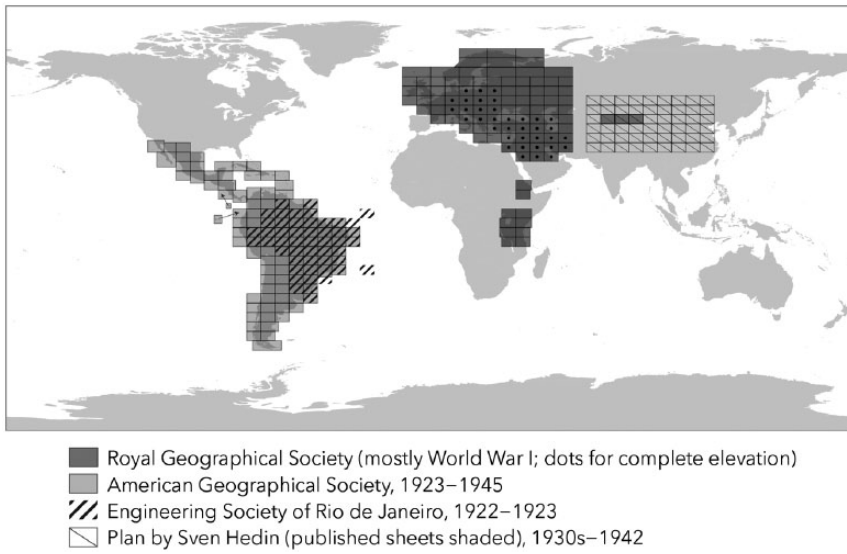

Figure 9. Coverage of the three unofficial IMW schemes before World War II, plus the plan announced by the Swedish explorer Sven Hedin. In contrast to the scattershot approach of the official mapping, private organizations tended to publish in large contiguous blocks.

Yet this obvious lapse was not so great a departure as it might at first appear. Indeed, in many ways it shows how both zombie projects and negative networks can thrive and how strongly the IMW remained aligned with questions of sovereignty and the Euro-American ideal of civilization throughout the interwar period. In particular, the category used to describe the rampant unofficial maps was 'provisional' – but this was a rather ambiguous term that performed important epistemic and political work. According to the international standards, the term 'provisional' was supposed to be reserved for maps that did not yet include complete elevation colors, as was often the case for official maps of Africa or Southeast Asia. But when the American Geographical Society described its Latin American maps as 'provisional' in the 1920s, they explained this meant that the maps were 'intended to serve only until the official definitive edition has been produced by the proper Hispanic American government' (American Geographical Society, 1946: 7). In other words, there was an important slippage between provisional geographic knowledge and provisional national autonomy. Both were seen as worthy of international attention, even if the latter was often criticized. Just as important, those very same cartographers who disparaged unofficial mapping on political grounds simultaneously gave high praise to the craft and usefulness of the illegitimate sheets, and they were routinely included in the project's annual reports. They were also used for international boundary negotiations and seem to have sold better than any of the authorized editions (American Geographical Society, 1935: 157).

The contrasts and continuities between the specifications of 1913 and the reality of interwar mapping are helpful for separating judgments about the project's output from

the history of the underlying network and its shared assumptions. If anything, the ongoing production of 'provisional' sheets – and the strong responses they provoked – should be seen as evidence that the IMW network was as robust as ever and continued to connect (negatively) those cartographers whose primary interest was in diplomacy, strategy, and national prestige rather than geographical scholarship alone. Similarly, the maps themselves did not disregard sovereignty at all; they were instead a powerful commentary on its importance, and they wore their illegitimacy quite proudly on their sleeve. The zombie projects still contributed to the original project, even if they ignored its public rationale. The first and second generations of the project thus offer a useful comparison. Just as it is entirely possible for a network of amicable colleagues to produce very little, a network may also remain perfectly viable even while its members feud and its own founding documents are used for new ends.

From principled to pointless

World War II was a major inflection point in the life of the IMW. Not only was the project's administrative hub in England destroyed by German bombs in 1941, but during the war non-IMW maps at the scale of 1:1,000,000 became militarized and ubiquitous in a way that they had not during the localized trench warfare of the 1910s. After the war, international mapping thus faced a radically transformed cartographic context. For the first fifty years of the project, its basic premise was that the world needed more and better maps – mapping was labor-intensive, expensive, and not always reliable. But after the war, mid-scale maps were suddenly quite plentiful, and the IMW was again reconceived.

During the late 1940s and 1950s, a third generation – mostly academic or civilian cartographers reacting against the overwhelming military flavor of wartime mapping – saw the IMW primarily as a global 'base map', that is, as an indispensable 'general' map that could act as a backdrop for 'special' or 'thematic' data that would be layered on in turn. This was both a practical ideal about how to print maps most economically and a conceptual diagram for the relationship between various kinds of geographic knowledge. But by the early 1960s, a fourth generation – cartographic pragmatists who had come of age during World War II – rendered this ideal largely unworkable, and as much as they (and their elders) still hoped that the IMW might act as a universal base map, actual mapping had increasingly drifted away from universalism and toward a one-to-one match between map design and the unique needs of a particular task. This tension finally came to a head in 1962, when the UN hosted a major conference to revise the map's specifications. Although the new standards were meant to rejuvenate the IMW, the resulting project was simultaneously too narrow and too broad. The hope was that it would help 'developing countries' to catalog their resources and attract outside investment, but it was not clear how this goal was furthered by a global plan of mid-scale mapping. This generational transition thus transformed the IMW from cartography's epistemic anchor to a seemingly pointless collection of national maps. These nationally specific zombie projects had a different flavor from those of the interwar period, and instead of the network becoming sustainably negative, interpersonal connections began to falter and the project was eventually seen as a grand failure despite nearly a century of production.

The IMW had been understood as a base map before the war – and it had even been used as such in a few fields, especially aviation and archaeology – but the post-war embrace of the base-map ideal was much more principled and responded directly to wartime mapping. During the war, the not-too-big–not-too-small scale of 1:1,000,000 had been found useful by all the major powers, Allied and Axis alike, and this mapping posed an existential challenge to the pre-war IMW. The greatest threat – by far – was the US Army Air Force's new World Aeronautical Chart (the WAC), a global series at 1:1,000,000 that by 1945 provided almost total coverage of the world's land areas in 950 sheets (Wright, 1950: 300). Although produced through rapid aerial photography and assembly-line drafting techniques rather than careful national surveying, the creation of the WAC essentially amounted to the realization of the entire program of the International Map in just under four years. Not only did it use similar graphic conventions, but sheets were again bounded by lines of latitude and longitude rather than natural or political boundaries. (The WAC, however, did use a map projection and additional symbols that were specifically needed for aviation.) At the founding of the International Civil Aviation Organization in late 1944, the United States even promised to turn over the WAC printing plates to its allies, so that the map could be maintained as an international civilian series after the war. As a result, by the late 1940s national mapping agencies saw little reason to prioritize their contributions to the IMW (Subcommittee 7 of Committee II: Aeronautical Maps and Charts, 1944; Wright, 1951).

For many geographers, however, the idea that an aeronautical chart might be used as the basic map of the world was quite illogical – or even insulting. Thus, although the IMW was still a state-sponsored project and was soon adopted by the UN, its most vocal defenders began once again to stress its scholarly potential. At the 1949 meeting of the International Geographical Union, for example, there were several proposals for new collaborative thematic mapping projects, all of which would benefit from some sort of international base map. Senior geographers from the United States and the United Kingdom floated ideas for globally coordinated maps of population and land use, while a well-known French academic called for new international maps for geology, precipitation, soil, agriculture, and vegetation. These new map series could not be printed on top of the WAC without great confusion. As the director of the French national mapping service put it the next year, what was necessary instead was a 'geographical map of a completely general character'. No 'special' map like the WAC, no matter how global or well maintained, could make up for the lack of a general series (Hurault, 1952: 17). In 1952, a committee of prominent geographers thus recommended that an official conference should eventually be convened to redesign the IMW so that it could act as a proper base map for all purposes – aviation included.

But in the ten years between this proposal and the final 1962 conference, none of the major international mapping projects, including the civilianized WAC, proceeded according to their original plan, and the universalist ideal became increasingly divorced from actual mapmaking. Of the half-dozen projects discussed in 1949, four projects were actually pursued: a World Land Use Survey, a World Population Map, a *Carte Internationale du Tapis Végétal* ('The International Map of the Vegetation and Ecological Conditions'), and an International Map of the Roman Empire, the last of which had been established in the late 1920s. Over the course of the 1950s and 1960s, all four projects

faced ongoing administrative problems and difficulties maintaining graphic uniformity, and although scores of maps were published in these series, by dozens of countries, only a very few actually used the IMW – or any single map series – as a base map. Not only did it prove impossible to design color palettes and symbols that could apply to all areas of the world, but this was soon regarded as a rather counterproductive goal in any case. What would actually make the maps *useful* was close sensitivity to local conditions, not global comparisons. These tradeoffs were often quite unavoidable, and at times the scale of 1:1,000,000 was far too coarse for local needs (Boesch, 1968; William-Olsson, 1963: 248). Even international cooperation itself was found to raise unnecessary confusion – or in the case of the Roman Empire, 'absurd national jealousies' – and by 1960 all four schemes had been reorganized either as entirely non-collaborative in nature or as just a loose coordination between incompatible national initiatives (Crawford, 1954: 363). The transformation of the civilian WAC was less dramatic, but by the early 1960s both its privileged place among aeronautical charts and its geographic ambitions had also been reined in. Although it was always described as the 'basic' international chart, over the course of the 1950s its specifications moved from appearing prominently as the first chapter in the official book of map standards to appearing seventh, simply one among many others; figure 10 shows a similar downgrading of its global reach.

During the same time, the very idea of a 'general' map was seriously challenged by exactly those practitioners who might most be expected to support uniform global mapping – namely, the cartographers of the US military. The clearest shift came from a new interest in social-scientific (often quantitative) research on the actual use of maps in the field, which immediately rejected the 'general' user as an unhelpful fiction. In the early 1950s, for example, the US Office for Naval Research commissioned research into design alternatives for the American WAC that used tests and questionnaires given to working pilots and navigators. The study's authors concluded that creating an '*all-purpose* chart' was, quite plainly, 'impossible' and that pilots would be much better served by a collection of simpler maps at a variety of scales. Paraphrasing statements by the head of the US Aeronautical Chart Service, they argued that 'each chart must be *tailor-made* for a particular purpose – a particular aircraft–mission combination' (Waters and Bishop, 1952: 75, 76). Over the next few years, Air Force cartographers explicitly reframed their goal as creating a 'family of charts' that could work together as an organic whole (Office of Naval Research, 1951: 17). Similar studies and a similar shift in attitudes took place in the Army as well. As early as 1953, a cartographer at the Army Map Service predicted that the 'military topographic maps of the future … will become more specialized and will be designed to meet the particular needs of the individual service users' (Finley, 1953: 491). This stance had direct relevance for the fate of the International Map, since during the 1950s the US Army was by far the largest producer of IMW maps throughout the world. (These sheets were not seen to be as deviant as the privately produced interwar maps, but they were not quite authorized, either.) Yet because these maps were mostly useful for planning or routine work by a few officers rather than on-the-ground troops or artillery, over the following decade they were given increasingly less priority (Army Map Service, 1959).

When the conference to redesign the IMW was finally held in 1962, there was thus a sharp tension between the various projects of international mapping, both civilian and

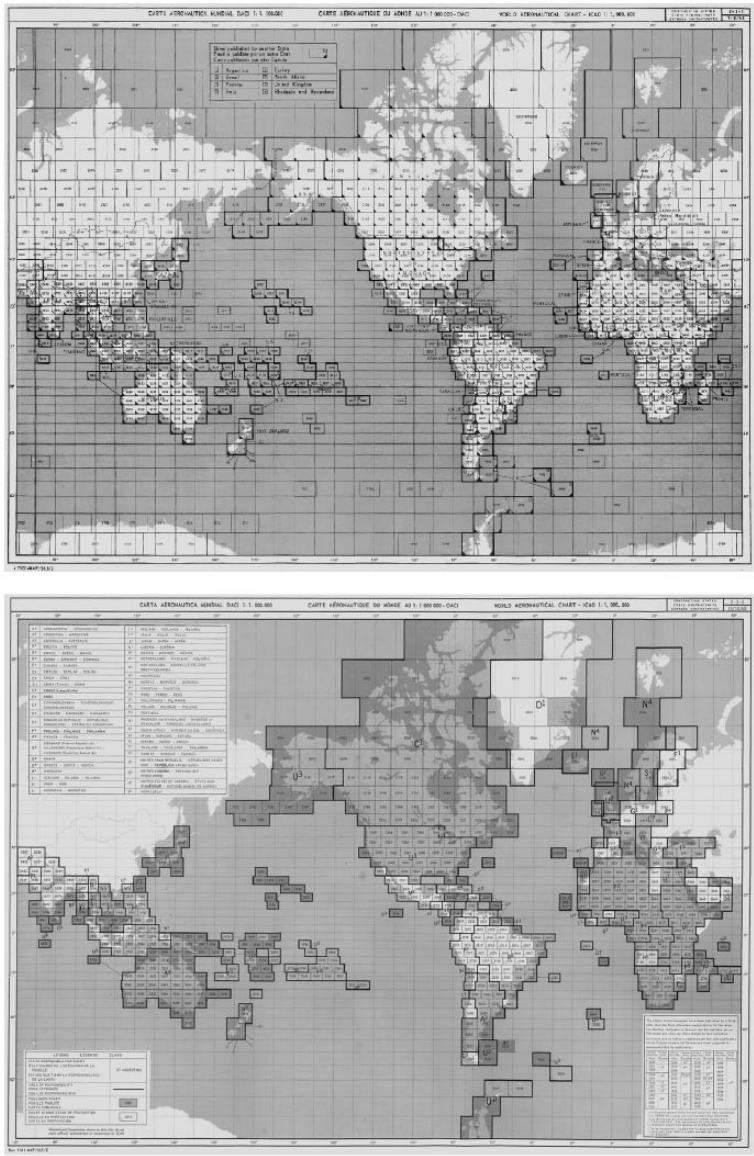

Figure 10. A subtle indication of the de-globalization of international mapping. These are index sheets showing coverage of World Aeronautical Charts produced to the standards of the International Civil Aviation Organization (ICAO), from March 1962 (top) and October 1962 (bottom). The earlier map shows a global system, one that includes all land areas of the world, even those covering non-member states like the USSR. The later map, in contrast, shows only sheets actually assigned. This was the only time the graphics of the ICAO index map were changed. From ICAO, *Aeronautical Chart Catalogue* [ICAO Doc-7101] (Montreal: ICAO).

military, and the network of practitioners still committed to the ideal of a universal base map. Without a doubt, universalism was still very much the goal, and the conference itself – held in Bonn, under UN sponsorship – was no small affair. It lasted three weeks, included 188 cartographers and diplomats from forty-two countries and four international organizations, and included a huge exhibition of several hundred 1:1,000,000 maps published since the late 19th century. The attendees were also uniformly optimistic. A leading German cartographer predicted that the conference would lead to the 'organic renaissance of a uniform world scale', with a 'true world map' achieved by 1980; similar statements were made by others as well. And although there was some disagreement about whether the IMW or the WAC should ultimately take precedence, during the meeting no one challenged the importance of creating a single, global map (Meine, 1960: 68–69).

But despite this agreement in principle, the actual debate at the conference stressed regional standards, decentralized decision-making, and the need for a more focused understanding of the map's audience. Regionalism was embraced by even the staunchest champions of universalism. The French and the British, for example, both proposed that symbols should not in fact be uniform around the world but should instead vary by climate or between 'highly developed' and 'less developed' areas. The American representative suggested that symbols for towns should not be standardized at all, since even within the United States variation was necessary for the sake of 'local conditions' (Ministère des Travaux Publiques et des Transports, 1962; UN Department of Economic and Social Affairs, 1963: 21, 63–64). This decidedly non-global bias was only underscored by attempts to better define the actual users of the map. In an article published just before the meeting, one of Britain's most prominent cartographers asked explicitly, 'What type of map-user should be kept in mind in redesigning the map?' (Crone 1962: 38). At the conference, the answer was given on the first day. In line with overall UN goals, the IMW would henceforth be a map for planning economic development. But besides a general push for portraying more 'economic features', this imagined audience proved to be rather unhelpful, and it only reinforced the idea that the IMW was not a worldwide series. After all, maps of the United States, Western Europe, or the USSR could hardly be justified as development assistance, and even jet-set technical experts shared geographers' preference for local specificity (UN Department of Economic and Social Affairs, 1963: 42).

As a result, the eventual (and much lauded) result of the conference was a rather drastic loosening of IMW specifications, in the name of 'modernization', 'flexibility', and 'economy'. Symbols were made less rigid, certain colors and variations were made optional, and the precise limits of sheet boundaries were turned into national decisions (UN Department of Economic and Social Affairs, 1963). In other words, far from establishing a tight merger of the IMW and WAC to create a uniform, universal base map, the conference instead emptied the IMW standards of much of their former prescriptive force. In updating the map to align with the disciplinary norms of a new generation of the IMW network, the project itself was fundamentally altered.

In keeping with this new decentralized ethos, work on the IMW in the years after the conference was increasingly undead – fragmented, national, and unpublicized – and the once-reliable contributions from the United States declined precipitously as military interest shifted elsewhere. Several countries did use the new specifications as a template for

national maps, but cartographers no longer voiced concerns about graphic homogeneity, and only very large countries like Canada and Australia fit their maps to the once-standard sheet grid. Most other countries adjusted the edges of their sheets for convenience, and cross-border continuity was not a priority. Even the UN secretariat freely admitted that the new IMW was no longer universal. Summarizing the work produced in the decade after the conference, it argued that the manifest 'lack of absolute uniformity in cartographical details has little, if any, effect on the usefulness of the sheets' – which is to say, there was no longer any felt need for international coordination or comparative study between continents (UN Department of Economic and Social Affairs, 1975: 5).

The crucial point here, however, is that the gradual decline of the IMW was entirely in keeping both with the prevailing norms of the field – intellectual, political, and otherwise – and with the enthusiastic resolutions of the 1962 conference. The IMW did not disperse *despite* the hopes and ideals of prominent cartographers, but *because* of them. And its fragmentation was not the result of controversy and disagreement, but widespread agreement. An international scientific network that had evolved through more than seventy years had finally assembled to bring its flagship project up to date, and the result was a resounding retreat from ongoing collaboration. International communication became less frequent, and annual reports began to be skipped; when the network was officially broken in 1986, there was not much left to break. Its disappearance was thus not a sharp discontinuity. It was instead a slow fade into oblivion driven by changing scientific goals and shifting national priorities.

Conclusion: Success, failure, and generational change

The public life of the IMW spanned four generations of practitioners: Penck and his immediate supporters, the national (or nationalist) mapmakers of the 1910s and interwar period, the base-map enthusiasts of the immediate post-war, and the maps-as-tools cartographers of the 1960s. The boundaries between these groups were not always sharp, and no generation was perfectly homogeneous. But even this basic subdivision makes it clear enough that the IMW cannot be analyzed as a single project pursued by a single network with a straightforward narrative arc. It was two rather different projects, each with its own undead offspring and each pursued for a variety of purposes under shifting sponsorship, with success measured differently in each generation.

In the past few decades, there has been a fifth generational network that has coalesced around the memory of the now-defunct IMW. As a fully negative network – that is, one united through critique, not collaboration – the goal is to analyze the IMW for lessons about the history of the twentieth century and the best way to pursue international mapping. Geographers and historians have cast the IMW as the Icarus of cartography, with universalist dreams that now seem laughably grand, straightforwardly imperialist, and embarrassingly modernist (Brotton, 2013: 437–446; Monmonier, 2008: 86–95). At the same time, practicing cartographers have looked to the IMW as a source of (negative) guidance for a potentially similar Japanese project for international cooperation in electronic geographic data. For the promoters of this 'Global Mapping' initiative, the alleged failure of the IMW is useful for highlighting 'the need for clear, consistent and manageable objectives' (such as today's 'clear focus on the environment') and the importance of

a single enthusiastic sponsor (in this case, Japan) (Pearson et al., 2006: 173; Rhind, 2000). In both cases, the IMW has become a fable with a clear moral about the epistemic and political project of Euro-American mapping. The first response shows why failure was inevitable, and the second wants to prevent similar failures in the future.

As should be clear by now, the historical problem with these reactions is that they assume a single scientific network working diligently, and ultimately unsuccessfully, on a single project. But there is also a lesson here about mapping in particular, since these recent responses tend to frame the IMW in terms that still have much in common with the regionalist and functionally specific mapmaking of the 1950s and 1960s. Indeed, some of the harshest critiques of the project in the 1960s are still cited today, especially those of the famous American cartographer Arthur Robinson, who argued that the 'design by committee' and 'attempt to serve too many purposes' had produced little more than 'cartographic wallpaper' (Robinson, 1965: 24). These statements are usually seen as insightful, not historical. In other words, this fifth generation is reconstituting a network of exchange – international projects, scholarly debate, and data standardization – that is just as situated as its predecessors, and it is still engaged in a conversation about the proper goals of cartography. Instead of championing an imperialist universalism, mapmaking must now be narrowly tailored and epistemologically humble. As someone concerned with present-day mapping, I generally agree with these sentiments, but as a historian I cannot take them as the final word. As long as the IMW remains historically relevant, its network and its norms will continue to evolve.

But by preserving the IMW simply as a project of disciplinary memory, these reactions also miss the project's ongoing activity. In 1992, for example, the US Geological Survey published a new IMW sheet of Antarctica; in 1995, Korea followed with six new maps of its own territory; in the late 1990s and early 2000s, Brazil published new editions of dozens of sheets. The IMW indexing system has also continued to be used on new maps by Hungary, Slovakia, Mexico, Germany, and France (Republic of Korea, 1996; WorldCat, 2016). None of this mapping has been coordinated or publicized through the UN – or anywhere else, for that matter. Apparently, the 1962 standards have simply continued to be helpful for structuring national mapping projects, even decades after the UN's formal dissolution of the network. Much like the unsanctioned mapping of the interwar period, zombie production continues apace, with the standards cut off from any collaboration but still calling forth new maps.

In other words, the conclusion here is not just that we need to see success and failure as historical categories and take retrospective assessments with a grain of salt – although we certainly should. The more important lesson is that we should not assume that the analytic category of network (or infrastructure) will be adequate on its own to explain historical change over the longue durée. We also need an analytic of *projects*, and we need to understand how both projects and networks can be sustained while turned inside out. Especially when analyzing the expansive collaborations and shifting megaprojects of the twentieth and twenty-first centuries – everything from particle physics or genomics to weather prediction and space exploration – we should not expect a choice between two simple narratives, one where a robust network leads to worthwhile results and the other where a faltering network signals decline and failure. Instead, we should expect networks and projects to diverge, reassemble, and diverge again, and we should be ready to analyze constantly shifting overlaps of collaboration, production, indifference,

anti-networking, after-networking, and undead creation. Multigenerational networks inevitably transform and can eventually dissolve without ever having failed, and collaborative projects, continually reimagined, can end up persisting long after cooperation has ceased.

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