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SMALL SCIENCE: PERSPECTIVES ON CONTEMPORARY SMALL-SCALE RESEARCH

Is Small Science Cargo Cult? Mimicry, Dependency and Agency in the Margins of Big Science

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Abstract: This paper argues that the application of the notion of cargo cults to science provides a valuable heuristic for revisiting the dichotomy between big and small science. By considering the use of the notion both by Cold War physicist and by anthropologists interpreting Melanese rituals, we suggest that cargo cult is better adapted (and adaptable) to small than to big science. We simultaneously understand small science as mimicry developed in a context of dependence upon big science and as a form of agency useful to counteract asymmetries of power in a world dominated by hierarchical forms of doing science.

Keywords: Cargo cults, big science, Cold War, historiography of science, agency.

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Is small science cargo cult? This provocative thought initially crept in me as I was looking anew at Derek Solla Price's *Little Science, Big Science* in order to put in their natural context the stimulating essays collected in this thematic dossier. At some point in the book, first published in 1963, Price commented on the increase in the scientists' social status over the past recent decades, especially in the United States and in the Soviet Union. Since they were in high demand, he explained, scientists enjoyed "an automatic raising of general salaries and of the research funds and facilities commanded by the prestige and *the cargo cult of modern science*."¹

Struck by the expression—which, I must admit, had hitherto been rather unfamiliar to me—I started to dig a bit deeper into the meaning of "cargo cult" for Cold War scientists and historians of science, in the hope of better understanding what was at stake here. Broadly defined, cargo cults are movements in which communities from the Southwest Pacific have been known to replicate the symbols or practices of technologically dominant outsiders in the belief that doing so will attract the material benefits and power those outsiders possess.² Inquiring into the process by which a concept forged to account for eccentric Melanese rituals was turned into a tool for understanding the most advanced mutations undergone by technoscientific societies unexpectedly spurred a few takeaways towards of a reformulation of the question at hand—whether small science is a useful historiographical category—which I hope will be of interest to the reader.

To Price, *Big Science* (always capitalized in the book) was not merely a set of new forms of doing science—a view that might have only been forcefully argued three decades later by Peter Galison and Bruce Hevly—but truly to be understood as a global transition, that is, the advent of a new era in the history of science.³ With this reference to cargo cults, Price voiced a skepticism regarding the rationale for the exponential increase in scientific funding that he associated with the big science phenomenon he was trying to capture. At first sight, one could read this sentence as Price avowing that the rise of big science hinged on elements of an irrational, not wholly well-grounded belief in the magical power of modern science. The consequence he seemed to fear was that social demands could gear scientific research in undesirable directions, unless scientists themselves got involved into politics. But, more

¹ Derek J. de Solla Price, *Little Science, Big Science* (New York: Columbia University Press, 1963), 95. My emphasis.

² For a short introduction, see Lamont Lindstrom, "Cargo Cults," *The Open Encyclopedia of Anthropology*, ed. Felix Stein. Facsimile of the first edition in *The Cambridge Encyclopedia of Anthropology* (2018) <http://doi.org/10.29164/18cargo>

³ Peter Galison and Bruce Hevly, eds., *Big Science: The Growth of Large-Scale Research* (Stanford: Stanford University Press, 1992); see esp. their own contributions to the volume: Peter Galison, "The Many Faces of Big Science," 1-17; and Bruce Hevly, "Reflections on Big Science and Big History," 355-363.

intriguingly, a closer reading revealed that “cargo cult” in Price’s sense applied rather more to little science than to big science.

In a book that despite its title by and large eschewed any serious attempt at defining what was meant by little science, this passage indeed provided Price with the occasion of drawing a sharp contrast with big science. In “the old days of Little Science,” he went on to say, scientists were “on tap but not on top.” They were “lone wolves” who valued their independence and refrained from political engagement: “on the whole they liked *things* but were not very good at *people*.” There was now an opportunity for scientists, he thought, to withdraw from “the old protective cloak of disinterestedness that was proper in the days of Little Science.” Price called for the political mobilization of scientists on the national and international scenes, for the “reconstruction of the entire fabric of science and for the external problems of science in the service of man.”⁴

Cargo cult thus was for Price an archaic way of conceiving the relationship between science and society, in which the social and technological benefits derived from scientific research were an unintended consequence of an otherwise autonomous process. It belonged to past, small-scale scientific practice when a focus on things (or “cargo”) was more important than on politics (that is, people and power), a time when trust in science was nothing more than a “cult” without rational basis. This, as I would like to argue here, was a profound misunderstanding of the political potency of cargo cults, which can be brought to bear on small science—understood as low-resource research practices—as a historiographical category with potent heuristic value.

Bamboo Antennas

At the height of the Cold War, the concept of cargo cult seemed to have had a special resonance for scientists and historians of science who believed they were witnessing a profound mutation in the social role of scientific practice. In an endnote, Price acknowledged that his main source for the concept was an article about science education by the Berkeley historian of science Hunter Dupree. In this opinion piece, Dupree expressed concerns that were indeed very close to Price’s. Like him, Dupree was interested in science policy, his 1952 PhD dissertation having been devoted to “the development of a statesman of science.” Dupree also concurred with Price in thinking that science was no longer the private reserve of a restricted number of men, but was now a fundamental player in national policies and

⁴ All quotes above come from Price, *Little Science, Big Science*, 112-115. Original emphasis.

international relations. This transformation, he argued, needed to be reflected upon the manners in which science education was to be conceived.⁵

Surprisingly perhaps, Dupree turned to the natives of Melanesia to make clear the failings of the current situation. “The habit of approaching science by way of technological end products produces an audience held in thrall by what we may call, by loose analogy from anthropology, a cargo cult.”⁶ He drew a vivid picture of its manifestations during the Second World War, claiming that it arose as a result of specific conditions, when some South Pacific islanders were suddenly exposed to the effects of Western technology without seeing “neither the industrial system nor the pattern of ideas which produced these unimagined riches.” In Dupree’s account, the Melanese’s reaction, “based both on close observation and on cause-and-effect reasoning,” seemed rather rational. But, grafting their imperfect understanding of the Westerners’ practices onto their own interpretation of Christian beliefs as well as native mythology, they started to behave rather strikingly: “They stopped work, neglected their tribal customs, and built bamboo antennas on their huts in order to communicate with the new messiah who would bring cargo to them!”⁷

The scientists who started to conceptualize big science in the early 1960s seemed to fear that the new modes of doing science would take over and totally replace older ones. Often credited with having popularized the idiom “big science,” Alvin M. Weinberg, who was the director of the Oak Ridge National Laboratory, feared that big science was “invading universities.” He called for big science to “flourish and, at the same time, keep it from trampling Little Science—that is, we must nurture small-scale excellence as carefully as we lavish gifts on [large-scale] spectacles.”⁸ In the time that separates us from this apprehension, small science has often reproduced the surface features of big science, such as the grant-writing genre, the team-building, the methodological buzzwords, the expectations of deliverables and impacts, etc. It may be tempting, then, to see small science as engaging in some forms of mimicry that may be reminiscent of cargo cults.

Mimicry is not always deception, but simply a way to get access to funding, institutional recognition and scientific legitimacy that may otherwise be elusive. Yet, as in Melanesian

⁵ A. Hunter Dupree, “Public Education for Science and Technology” *Science* 134 (1961): 716-718. Dupree’s dissertation was published later as *Asa Gray, American Botanist, Friend of Darwin* (Baltimore: Johns Hopkins University Press, 1988).

⁶ Dupree, “Public Education,” 717.

⁷ Dupree, “Public Education,” 717.

⁸ Alvin M. Weinberg, “Big Science: Marvel or Menace?” *The New York Times Magazine* (23 July, 1961), 15, 47 and 51, on 15. The quote is also almost exactly the same in idem, “Impact of Large-scale Science on the United States,” *Science* 134 (1961): 161-164, on 162. See also idem, “The Federal Laboratories and Science Education,” *Science* 136 (1962), 27; and idem, *Reflections on Big Science* (Cambridge: M.I.T. Press, 1967).

cargo cults, the reproduction of surface forms does not always translate into material results. Among scientists, “Cargo Cult Science” was made famous by the physicist Richard Feynman as a fraudulent scientific practice that adopted the appearance of methodological rigor without internal validity. In his 1974 commencement address at Caltech, the physicist claimed that there were people in “the South Seas” who upon coming into contact with airplanes full of good materials during the Second World War started to replicate modern infrastructures in the hope of getting such “cargo” for themselves. They built runways and placed fires on both sides. In a hut, a man “with two wooden pieces on his head like headphones and bars of bamboo sticking out like antennas” played the role of the air controller.

They’re doing everything right. The form is perfect. It looks exactly the way it looked before. But it doesn’t work. No airplanes land. So I call these things Cargo Cult Science, because they follow all the apparent precepts and forms of scientific investigation, but they’re missing something essential, because the planes don’t land.⁹

In order to ensure that planes land, we need to check the soundness of our assumptions. Feynman illustrated the point with an example that belonged to psychology and involved a mysterious “M. Young” having rats running in a maze.¹⁰ According to Feynman, this experimental result which guaranteed the very possibility of drawing scientific conclusions from similar experiments was never cited by the literature, an omission that rendered all results unreliable: “not paying attention to experiments like that is a characteristic of Cargo Cult Science.”¹¹

Cargo cult science however was not necessarily small science. Feynman also told the story of a scientist working at the National Accelerator Laboratory who relied on someone else’s experiment as baseline, because he could not get time on the expansive machine: “the men in charge of programs at NAL are so anxious for new results, in order to get more money to keep the thing going for public relations purposes, they are destroying—possibly—the value of the experiments themselves.”¹² The pressure put on researchers by big science may have made it more fragile with respect to the danger of cargo cult.

⁹ Richard P. Feynman, “Cargo Cult Science,” *Engineering and Science*, 37 (7) (1974): 10-13, on p. 11; repr. Idem, *Surely You’re Joking, Mr. Feynman!: Adventures of a Curious Character* (New York: W. W. Norton, 1985), 338-346.

¹⁰ The exact reference alluded to here is difficult to establish. See Gwern Branwen, “Feynman’s Maze-Running Story,” <https://gwern.net/maze>

¹¹ Feynman, “Cargo Cult Science,” 13.

¹² Feynman, “Cargo Cult Science,” 13.

Cultural critics like Homi Bhabha have helped understand that mimicry is not passive imitation, but a complex, ambivalent form of agency.¹³ In this view, small science mimics big science not because it misunderstands it, but because its institutional survival depends on speaking the dominant idiom. Mimicry, in this sense, is a survival strategy—one that reveals and contests the codes of power within scientific practice.

Cargo

Small science is often understood as an alternative to big science—more creative, slower, more ethical, or more authentic. But this dichotomy fails to capture the structural dependency that has developed between diverse forms of scientific practice. *Science et Suprascience* was the awkward title under which Price's book was translated into French.¹⁴ While the neologism was perhaps unfortunate—and never caught up—the use of “suprascience” actually points with some lucidity to a different understanding of the relations between science practices than the one usually implied by the little science/big science dichotomy. The new forms of doing science Price was after in his books, it seemed to imply, were not *opposed* to traditional approaches. They towered above them. They were not destined to replace ancient manners of doing science, but to develop as superstructures both feeding on older, but subsisting, modes of practicing science and repurposing them to higher aims. Small science thus did not operate *outside* big science. It depended on it—for citation networks, journals, infrastructure, technologies, and epistemic models.

Small science therefore was cargo cult in a second sense. Its conditions of existence relied on the circulation of scientific “cargo” originating in more powerful scientific institutions. To illustrate this point, one may turn to the extensive article published by the British anthropologist Peter Worsley in *Scientific American* in May 1959, which may have been an important source of inspiration for both Dupree and Feynman.¹⁵ The anthropologist indeed recounted the story that so struck them:

The G.I.'s who landed in the New Hebrides, moving up for the bloody fighting on Guadalcanal, found the natives furiously at work preparing airfields, roads and docks for the magic ships and planes that they believed were coming from 'Rusefel' (Roosevelt), the friendly king of America.¹⁶

¹³ Homi K. Bhabha, “Of Mimicry and Man: The Ambivalence of Colonial Discourse” *October* 28 (1984): 125-133.

¹⁴ Derek J. De Solla Price, *Science et Suprascience*, trans. Geneviève Lévy (Paris: Fayard, 1972); *Little Science, Big Science* (New York: Columbia University Press, 1963).

¹⁵ Peter M. Worsley, “Cargo Cults,” *Scientific American* 200, no. 5 (1959): 117-131. See Peter M. Worsley, *The Trumpet Shall Sound: A Study of “Cargo Cults” in Melanesia* (London: MacGibbon & Kee, 1957).

¹⁶ Peter M. Worsley, “Cargo Cults,” 117-118.

This is a very detailed article in which Worsley identified more than sixty instances of “cargo culting” sometimes dating back to the end of the nineteenth century not only in Melanesia, but across the South Pacific in places like Fiji, New Caledonia, the Solomon Islands and New Guinea. Leafing through this issue of the magazine, however, the eye is irresistibly caught up by the overflowing number of advertisements that surrounded the article. This seemed aptly to capture the big science phenomena Price was after and stood in stark contrast with the primitive customs that are the topic of the article.

One ad after the other reinforced the impression that science had entered a new era. The Isotope Division of the Oak Ridge National Laboratory announced that: “For the first time, *kilocurie* quantities of long-lived radioactive elements are available for your development work” and that cerium-144, cesium-137, promethium-147, strontium-90, and technetium-99 could now be ordered at a low price. Dow Chemicals showcased a “revolution in industrial thinking. . . in the recent years.” Another ad featured two men loading a missile onto a jet with the slogan: “At Philco the world of tomorrow is NOW!” Kennametal touted their manufacturing of machine parts able to withstand temperatures as high as 2200 F and 646-mph flows, while the Fafnir ball bearings company offered to help “when you want to touch the untouchable.” Technical Operations, Incorporated announced it was looking for highly qualified personal to conduct studies for the Office of Civil and defence Mobilization regarding the consequences of fallout of a large nuclear attack on the United States. We could go on.

In other words, if Worsley’s anthropological studies could be taken as an example of small science, it seemed to be allowed to exist only in the shadow of big science undertakings. Margins and text appeared almost inverted. Small science lived in the margins of big science.

That small science coextended with big science was already acknowledged by Price. For him, as we have seen, Big Science was a transition. Mobilizing the metaphor of a phase transition, Price—a physicist by training—underscored that what interested him most was not the myriads of ways in which scientific studies, like molecules, behaved, but the large-scale transformation of the social conditions in which they were conducted. He therefore never claimed that in the new regime, there were no place anymore for small-scale research projects. “What shall concern us is not so much,” he wrote in his own catchy way, “that Little Science was sometimes big and Big Science little.”¹⁷ While Price famously developed the “invisible college” metaphor to discuss the way big science retained the feel of a village of yore, he had precious little to say about how, in the new era, small science developed in a form of dependency on big science.

¹⁷ Price, *Little Science, Big Science*, 4.

Such a relation of dependency is not unique to small science. Postcolonial theorists have shown that global knowledge production operates through *coloniality*: the reproduction of core-periphery hierarchies that constrains the autonomy of marginal actors.¹⁸ Small science in the Global South or in underfunded disciplines often found itself structurally forced to engage with hegemonic agendas and formats. Far from being separate from big science, small science was a form of subaltern knowledge that could only exist as a part of big science, but in subordinated position. Its cargo-cult mimicry should then not be seen as a choice but as a function of epistemic asymmetry.

Power and Desire

Cargo cults are not only a reaction of people from the Southwest Pacific to the irruption of modern technology in their native lands, but also a reflection on Western technological imaginations. As such, the meaning given to the concept itself by anthropologists has also undergone significant changes since the moment it first appeared. Cargo cult was first conceived as a form of calumny which not only infantilized native population but also idealized modern technology. In a very useful recent review of anthropologists' various opinion on the cargo cult concept, Lamont Lindstrom recalls that the expression first popped up as a derogatory term in a colonial news magazine.¹⁹ In the November 1945 issue of the *Pacific Islands Monthly*, cargo cults were associated with madness:

A native, infected with the disorder, states that a great number of ships loaded with 'cargo' had been sent by the ancestor of the native for the benefit of the natives of a particular village or area. But the white man, being very cunning, knows how to intercept these ships and takes the 'cargo' for his own use.²⁰

Already in this formulation, agency seemed to be blurred. Cargo cultists reclaimed ownership over modern technology by integrating it in their own culture. In the period between 1954 and 1964, which Lindstrom calls the "golden age" of cargo cult research among anthropologists, comparatist approaches hinged on what exactly, cargo signified. Some interpreted the phenomenon as a form of emancipation from colonial oppression quite independent from technology. "The most significant theme in the Cargo seems to be

¹⁸ On coloniality, a concept first forged with respect to Latin American studies, see Aníbal Quijano, "Coloniality, Modernity/Rationality," *Cultural Studies* 21 (2007): 168-178; and Walter D. Mignolo, *Local Histories/Global Designs: Coloniality, Subaltern Knowledges, and Border Thinking* (Princeton: Princeton University Press, 2000). For reviews, see Santa Arias, "Coloniality and its Preoccupations," *Latin American Research Review* 48 (2013), 214-220, and Linda Martín Alcoff, "Mignolo's Epistemology of Coloniality," *CR: The New Centennial Review* 7, no. 3 (2007): 79-101.

¹⁹ Lindstrom, "Cargo Cults."

²⁰ N.M. Bird, "Is there danger of a post-war flare-up among New Guinea Natives?" *Pacific Islands Monthly* 16 (4 November 1945), 69-70; quoted in Lindstrom, "Cargo Cults."

moral regeneration: the creation of a new man, the creation of new unities, the creation of a new society.”²¹ Cargo cult was reframed, not as irrational rituals, but as strategic responses to cultural hegemony and power imbalance. It is therefore tempting, if we want to go further with this framework, to analyse small science as a cargo-cult-like reclamation of power in the face of an unequal balance of power between new forms of scientific practice. Small science mimicry, viewed through this lens, can similarly be understood as epistemic stratagem: a way of claiming presence and participation in a system designed to exclude certain voices.

More recently, however, cultural critics have come to view the very concept of cargo cult with a great deal of suspicion. As Holger Jebens explained in the introduction of a collected book, “[t]he more Western cargo discourses were dissected, the more the term “cargo cult” turned into a highly contested label.”²² Some authors, like Martha Kaplan, questioned whether cults truly existed, while other like Elfriede Hermann even stated “a need to reconsider the advisability of its use at all.”²³ Indeed, Lindstrom concludes his 2018 review by acknowledging that “few ethnographers apply the label today.”²⁴

Having faded away from modern-day Melanesia, as it fell out of favour among Western anthropologists, cargo cult persisted and thrived in popular culture. Lindstrom’s understanding is that: “Cargo stories are desire stories. They function to remind us how modern, consumerist desire operates.”²⁵ As such, they exert a strong appeal to the contemporary mind striving for impossible self-improvement through technology both taunted and made unattainable by the marketplace.

Small science can thus be seen as the expression of an unfulfillable desire in the context of big science dominance. Its affirmation as a possible alternative, like cargo cults, disrupts and remakes prevailing norms through strategic inhabitation, not wholesale rejection. Small science’s mimicry should therefore be seen not as opposition, much less desperation, in the face of big science hegemony, but deliberate political action. Compliance—and indeed defiance—must be viewed as partial, ambivalent and laden with a potential for subversion.

²¹ K.O.L. Burridge, *Mambu: A Study of Melanesian Cargo Cults and Their Social and Ideological Background* (London: Methuen, 1960), 246-247; quoted in Lindstrom, “Cargo Cults.”

²² Holger Jebens, “Introduction: Cargo, Cult, and Culture Critique,” in *Cargo, Cult, and Culture Critique* (University of Hawai’i Press, 2004), 1-14, on 4.

²³ Elfriede Hermann, “The Yali Movement in Retrospect: Rewriting History, Redefining ‘Cargo Cult’,” *Oceania* 63 (1992): 55-71, on 69; quoted by Jebens, “Introduction,” 4. See Martha Kaplan, *Neither Cargo nor Cult: Ritual Politics and the Colonial Imagination* (Durham: Duke University Press, 1995). See also Lamont Lindstrom, *Cargo Cult: Strange Stories of Desire from Melanesia and Beyond* (Honolulu: University of Hawai’i Press, 1993).

²⁴ Lindstrom, “Cargo Cults.”

²⁵ Lindstrom, “Cargo Cults.”

Shedding light on small science practices therefore appears absolutely essential to better understand how big science has given rise to the possibility of power reconfigurations from within.

Closing Remarks

Beyond the provocative stance, I have tried to argue that the affirmation according to which small science can be understood as cargo cult therefore has a heuristic value. With a little bit of poetic license, it may perhaps help historians of science to focus their attention on asymmetric power structures inherent to contemporary knowledge systems. By assessing small science's potential roles and places within these systems, it confers new meaning to relations of mimicry, dependence and epistemic authority.

As an historiographical category, therefore, small science is not only useful in highlighting alternative scientific practices in twentieth and twenty-first century science. Small science is not simply to be interpreted as littler or older than big science. Small science is a positional category—it is science performed under conditions of structural marginality. Historiography of science must thus shift away from size or scale as a single defining criterium. Instead, it must attend to the structure of dependency, the modes of mimicry, and the forms of agency that define scientific practice under modern-day constraints. Nothing, as a result, can be further from Little Science as understood by Price than small science. Rather than looking backwards to a mythical, pre-political time of scientific disinterested, small science as we reimagined it through the lens of the cargo cult metaphor unescapably becomes a potent means mobilized by marginalized actors for reclaiming power away from the dominant big science infrastructures. As cargo cult, small science is a crucial form of resistance historians of science urgently need to reconsider.

Competing interests

The author has declared that no competing interests exist.