Practising Comparison
Deville, Joe, Guggenheim, Michael, Hrdličková, Zuzana

Published by Mattering Press
Deville, Joe, et al.
Practising Comparison: Logics, Relations, Collaborations.

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STEVE JOBS, TERRORISTS, GENTLEMEN, AND PUNKS: TRACING STRANGE COMPARISONS OF BIOHACKERS

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INTRODUCTION

IN THIS PAPER, I WANT TO REFLECT AND SHED NEW LIGHT ON ONE OF MY current research topics: biohacking. While I have been researching biohacking for a few years now, to date I have not yet examined its comparative dimension. The themes I have investigated thus far revolve around the materiality, boundaries, and ethics of biohacking. However, so far I have not problematised or made visible the issue of comparison, despite the fact that comparisons abound in discussions about biohackers. This article is thus an opportunity to use a comparative optics to ‘make new discoveries’ (Yengoyan 2006) on a subject that I felt I already knew well.

Biohackers are people who hack and tinker with biology. On the one hand, the phenomenon of biohacking can be easily localised (both temporally and spatially). The movement emerged in 2007/2008 and has largely developed in large US and European cities. On the other hand, in order to understand and analyse the phenomenon, comparisons with a wide and heterogeneous set of
figures are made by science journalists and practitioners alike. For example, biohackers are concurrently compared to the following: seventeenth-century gentlemen amateurs; terrorists (whom Western powers usually locate in the East); the punk movement that emerged in the 1970s and their do-it-yourself ethics; and Steve Jobs and the Homebrew Computer Club.

The term biohacking is used today to designate a wide array of practices including the hacking of expensive scientific equipment by building cheaper alternatives; producing biosensors to detect pollutants in food and in the environment; and genetically re-engineering yoghurt to alter its taste, make it fluorescent, or produce vitamin C. Biohacking mobilises and transforms both molecular biology techniques and the ethics of hacking/open source. As such, it can be seen as a recent phenomenon. Its emergence as a distinct and visible movement can be traced back to the past eight or nine years. In 2008, for instance, DIYbio (the first association dedicated to do-it-yourself biology) was created.\(^1\) Two years later, the *Biopunk Manifesto* (2010) was written by Meredith Patterson, one of the leading figures in the biohacking movement. In addition, at the time of writing this paper, there are a number of associations, laboratories, wikis, websites, and so on, dedicated to biohacking.

The rise of the biohacker movement has caught the attention of journalists and academics alike. Academics have followed and analysed the movement since around 2008 (see Schmidt 2008a; Bennet et al. 2009; Ledford 2010), and two books dedicated to the subject have recently been published: *Biohackers: The Politics of Open Science* (2013), by science and technology studies (STS) scholar Alessandro Delfanti, and *Biopunk: DIY Scientists Hack the Software of Life* (2011), by science journalist Marcus Wohlsen. In one way or another, this body of work has examined the ethics, risks, potentials, and openness of the movement.

The geographical spread of biohacking – like its temporal emergence – can also be delineated. According to the main website in the field (DIYbio.org), there are currently eighty-five DIY biology laboratories in the world, of which twenty-eight are located in Europe, and thirty-five are in the US on either the east or west coast. There are now biohacker labs and biohackers in cities like New York, Boston, Paris, San Francisco, Manchester, Vienna, and in recent years,
initiatives have developed in places like Japan, Indonesia, and Singapore. The political geography of biohacking (and consequently, the arguments developed in this paper) thus needs to be emphasised. The biohacker movement is developing in Western and Westernised countries; laboratories are usually located in urban or suburban settings; and English is the lingua franca for the majority of the websites, articles, mailing lists, discussions, and wikis devoted to biohacking.

This paper focuses on how, and to what, biohackers are compared. This is a challenging question, for as we will see below, biohackers are compared to rather unlikely bedfellows. Not only are plentiful comparisons being made, but they are also drawn between different cultures and times, and between different – sometimes opposing – values and ethics. Unlike the ‘comparator’ which needs to be actively assembled, fed, and calibrated in order to provide comparisons (Deville, Guggenheim, and Hrdličková 2013), in the case of biohackers, comparisons are ‘already there’ and they are omnipresent. The frequency and disparity of these comparisons are what caught my interest in comparison and what compelled me to write this chapter. Why are such comparisons mobilised and why are such unlikely figures put side by side? What kinds of effects do such comparisons afford? How should we analyse these comparisons?

It is not unusual for hackers and computer programmers to be compared. Computer hackers, for instance, have been compared to public watchdogs, whistle-blowers, elite corps of computer programmers, artists, vandals, and criminals (see Jordan and Taylor 1998), while recent hacker networks like the Anonymous group have been compared to industrial machine breakers, and to Luddites (Deseriis 2013). The Homebrew Computer Club (initially a group of ‘hobbyists’) eventually became a group of ‘business entrepreneurs’ (see Coleman 2012), and Steve Jobs is today being compared to people like Thomas Edison or Walt Disney.

Using biohacking as a case study, I will reflect upon and problematise comparison. The list of potential benefits of comparison is long, and it is worth mentioning a few, such as how they help to explore new, unanticipated routes; move beyond national frameworks by varying scales of analysis; and identify social patterns while highlighting the singularity of the cases studied (de Verdalle et al. 2012). The practices, methods, and problems of comparison
have been discussed in a number of academic texts over the past decade or so. For instance, Richard Fox and Andre Gingrich (2002) have made an important contribution by revisiting and (re)theorising comparison. Arguing that comparison is a basic human activity that deserves academic scrutiny, they lay out a specific programme for comparative approaches. Differentiating between weak or implicit comparison, and strong and explicit comparison, Fox and Gingrich push especially for the latter and highlight their plural nature (2002: 20). The explicit focus on comparison has now become increasingly common, so that people talk of a ‘comparative turn’ in the social sciences (see Ward 2010). In this sense, comparison is actively engaged with, problematised, and theorised. This interest is visible beyond the Anglo-Saxon world as well. In France, for instance, two collections of essays on comparison have been published in 2012 alone: one is in the journal *Terrains et Travaux* (featuring on its cover an orange and an apple – a classic image that at once depicts sameness and difference, and is one of the chief challenges of comparison). The other is in an edited book called *Faire des Sciences Sociales: Comparer* (Remaud, Schaub, and Thireau 2012).

In this article, I want to draw on this body of work in several ways. First, I am interested in several authors’ emphases on ‘thick’ and multidimensional comparisons. Ana Barro, Shirley Jordan, and Celia Roberts (1998) have argued that comparison should be explorative, thick, and multidimensional. Jörg Niewöhner and Thomas Scheffer – who also argue for a ‘thick’ comparison – further emphasise that comparisons are performative in that ‘they connect what would otherwise remain unconnected, specify what would otherwise remain unspecified, and emphasise what would otherwise remain unrecognised’ (2008: 281). In a related way, Joe Deville, Michael Guggenheim, and Zuzana Hrdličková (this volume) talk about approaches that actively ‘provoke’ comparisons, while Tim Choy (2011) examines what comparisons do.

Second, I do not want to ‘solve’ the issue of comparison, nor tell a coherent account of what biohackers are and what they are not. I am, rather, exploring the *problems* that biohackers and their identities entail. In this sense, I follow Adam Kuper (2002) who reminds us that we have to ‘begin with a problem, a question, an intuition’ (2002: 161). He further writes:
I remain convinced that methodological difficulties are the least of our problems [...] We lack questions rather than the means to answer them. What we need in order to revive the comparative enterprise is not new methods but new ideas, or perhaps simply fresh problems (Ibid. 162).

I hold that biohackers are possibly such a ‘fresh problem’ since their identity is somewhat ambiguous and unclear, and since the probable risks and innovative potential of their activities are currently being debated. Discussions about biohacking reveal that there are many uncertainties and that it seems difficult to put their identity into neat categories. The questions that seem to drive most biohacking comparisons – Who are they? How can we make sense of them? Are they to be feared or hailed? – seem to have no clear answer.

Third, I also draw on Donna Haraway’s and Marilyn Strathern’s ideas around ‘partial connections’ and positionality. In her discussion about situated knowledge, Haraway writes:

[...]

She continues:

I am arguing for politics and epistemologies of location, positioning, and situating, where partiality and not universality is the condition of being heard to make rational knowledge claims [...] Feminism loves another science: the sciences and politics of interpretation, translation, stuttering, and the partly understood (Ibid. 589).

In her book Partial Connections (1991), Strathern further draws on Haraway’s work and uses the term ‘partial’ to say that ‘for not only is there no totality, each part also defines a partisan position’ (1991: 39). The trope of ‘partial connections’ can be – and already has been – engaged with in work on comparisons.
For instance, Endre Dányi, Lucy Suchman and Laura Watts (cited in Witmore 2009) have compared seemingly incompatible field sites (a renewable energy industry, the Hungarian Parliament, and a research centre in Silicon Valley) and noted that there can be a ‘remarkable repetitiveness’ when these sites are connected through specific themes (such as newness, centres/peripheries, place, and landscape). Others have talked about ‘partial comparisons’ (Jensen et al. 2011) as a way to think about multiplicities while still recognising that ‘there exists no single, stable, underlying nature on which all actors have their perspectives’ (Ibid. 15). In this paper, I want to use these ideas in order to avoid one pitfall: the depiction of biohackers as a coherent whole that is able to be summated according to the different parts and comparisons reported in this article. In other words, the comparisons made can only be ‘partially connected’: I will thus refrain from taking an analytical view ‘from above’, one that is detached from what takes place ‘on the ground’. Instead, I will follow the actors themselves and consider their comparisons and knowledge claims to be valid and legitimate. In the remainder of this paper, I look in turn at four comparisons of biohackers (Steve Jobs, punks, amateurs, and terrorists). I will think with biohackers about comparison, rather than think about biohackers’ comparisons. In doing so, I not only seek to examine what comparisons do and produce, but I will also be reflexive and critical about my own previous research.

FOUR COMPARISONS OF BIOHACKERS

Comparison One: Steve Jobs and the Homebrew Computer Club

At the first meeting of the DIYbio group in Boston in 2008, the comparison between do-it-yourself biology and the Homebrew Computer Club had already been explicitly made. Jason Bobe (2008), one of the founders of the movement, asked: ‘Can DIYbio.org be the Homebrew Computer Club of biology?’ While the relation was posed as a question, it did not take long for practitioners to talk more boldly about ‘promises’ and ‘potentials’:
The promise of the DIY Biology movement opens up biology to potentially create the next Silicon Valley. They are Steve Jobs and Bill Gates of the mid-1970’s or the Mark Zuckerberg of early 2000’s. Imagine just before the PC or social media explosions (OpenWetWare 2014).

DIY biology has been featured in a great number of articles in the news media, including Le Monde and Libération (France), the Guardian and Sky News (UK), Die Zeit (Germany), and the New York Times (US). A large number of these articles mention Steve Jobs along with biohacking. In a report about DIY biology on the BBC, we read, for instance, that

the organiser […] believes in the value of the amateur. He says the industrial revolutions brought about by steam and computing were driven by creative individuals – think Bill Gates and Steve Jobs in California in the 70s, toiling in garages, changing the world. The coming revolution will be biological and DIY will play a key role (Shukman 2012)

In a recent survey on DIY biology, one practitioner asked the following rhetorical question:

what if government had told Steve Jobs that he couldn’t play around with microprocessors because they could be used for missile guidance systems? (DIYbio community survey 2013)

In my research on biohacking, I have come across such comparisons many times. However, until writing this article, I never really considered them as such. Despite their frequency and the fact that they were articulated by practitioners themselves, the comparisons somehow seemed to be filtered out by my own theoretical and methodological grid. Why? Perhaps it was due to their hypothetical nature and overtly optimistic tone and claims. Perhaps it was also because innovation in the ICT domain is not my research area. Perhaps it was a combination of both of these elements. This is the first lesson that I have learnt in writing this chapter: there are some comparisons I feel more comfortable with
than others, and some I more readily engage with. This first lesson leads me to formulate some questions to keep in mind for my own future work: Why do I follow some threads and not others? Can I be more symmetrical in following a wider array of comparative tropes (if not all of them) which are visible in my empirical material? Or, conversely, should I be selective and only follow some comparisons?

The pertinence (or robustness) of a comparison between DIY biology and Steve Jobs could be dissected and criticised. Yet, with others (e.g. Schmit 2008b), I argue that this issue needs to be left aside here, for this would distract us from a key aspect of such a comparison: understanding what such a comparison does. Linking DIY biology to Steve Jobs produces a promise; it is a promissory comparison. It places a familiar success story side by side with a far less known story – a story-in-the-making. It offers a narrative of expansion – from a garage to a company, from a small group of individuals to a large corporation. And it offers a narrative of change, innovation, and revolution. Such a comparison, in other words, produces a folding of temporality (past, present and future), scale (local and global), and notoriety (unknown and famous).

Let me reformulate my question: What does this comparison do to the identity of biohackers? In order to find an answer, a quote from biologist Robert Carlson (2007) – one of the first persons to have talked about ‘garage biology’ – proves insightful. He wrote: ‘[w]hether at the hands of Michael Dell, Steve Jobs and Steve Wozniak, the Wright Brothers, Otto Lilienthal, William Boeing, or the yet-to-be-named transformative individuals working in biology, successful innovation requires wide access to both technology and a multitude of parts’ (Carlson 2007: 116). Carlson offers, en passant, an interesting and intriguing category: ‘the yet-to-be-named transformative individuals working in biology’ (Ibid.). Programmer and venture capitalist Paul Graham (2012) made a somewhat similar statement:

We know there’s room for the next Steve Jobs. But there’s almost certainly also room for the first <Your Name Here>.
Comparing biohackers to Steve Jobs does something very specific: it produces a category for biohackers – a category that is open and future-oriented. This first comparison demonstrates that biologists can help us in our sociological analyses. It therefore makes sense for scholars to ‘follow the actors’ on the ground, and to take their descriptions and discourses seriously and be open to the analyses they provide. My position here is not only that we need to follow the actors, but also that we need to ‘follow the comparison’ from where it is made.

**Comparison Two: Punks**

The next comparison I want to explore is the one between the biohacker movement and the punk movement. A first observation is that the terms ‘biopunk’ and ‘biohacking’ are sometimes both used to describe one and the same thing. For instance, in her *Biopunk Manifesto*, Patterson (2010) alternatively uses the terms biohackers and biopunks. She writes that ‘[w]e the biopunks are dedicated to putting the tools of scientific investigation into the hands of anyone who wants them’ and that biopunks ‘experiment’ and ‘deplore restrictions’ on research. At the same time, she writes that biohackers are committed to involving themselves in the political world and that they aim at ‘creating new scientists out of everyone we meet’. Science journalist Markus Wohlsen’s book, *Biopunk: DIY Scientists Hack the Software of Life*, contains the term ‘punk’ in the title, but rather uses the terms ‘DIY biology’ and ‘hacking’ throughout the book. In both of these texts, the terms are used on equal grounds: biohackers are biopunks, biopunks are biohackers. Actual comparisons can be found in the texts of two STS scholars. Delgado, for instance, writes that

[i]n a DIYbio context, the use of tinkering seems to point to unruly and punk combinations […] In their punk, unruly, domestic, and unfinished character, DIYbio designs hail heterogeneity and precariousness (2013: 69–70).

Moreover, in a blog post, I reflected upon the parallels between punk music and biohacking:
The infamous album Never Mind the Bollocks, Here’s the Sex Pistols (1977) can actually offer us some food for thought for reflecting about biohackers and biopunks […] Never Mind turned out to be a highly influential album, a milestone in punk and rock music. It changed music. Punks, nowadays, are a recognisable figure in terms of music, fashion, revolts, and anti-establishment attitude. Will biopunks bring about a similar cultural revolution in science and technology? Will biohackers change, and have a tangible influence on, scientific practice, scientific institutions, and technologies? (Meyer 2012).

Both Delgado’s comparisons, and my own, are rather tentative. While we both highlight the comparability between biohacking and punk, we are rather cautious in doing so (things ‘seem to point to’, and questions, rather than assertions, are formulated). Compared to the comparison with Steve Jobs – which is promissory and produces a (future) category – this comparison seeks to do something else: it is an analytic comparison. It tries to compare qualities and characteristics between two movements and thereby holds that a comparison sheds interesting light on an issue. What we both missed in our texts, however, is that punk can also be conceived as a counterpart. DIYbio co-founder Bobe, for instance, argued for the need to be transparent, friendly, and open to dialogue, and stressed that ‘we want to encourage people not to be punk’ (Delfanti 2013: 127). In other words, Bobe highlights difference, contrast, and non-comparability.

A noteworthy episode here is a forum discussion titled ‘Wikipedia clean up’, that took place in September 2012 (DIYbio discussion forum 2012/13). The first post opening the discussion stated that three Wikipedia articles – the ones on biohacking, DIYbio, and biopunk – were ‘awful’, and asked whether anyone wanted to do ‘clean-up duty’. During the discussion that followed, several issues were raised and various comments were made. On the one hand, it was suggested that the articles could be merged for they were seen as ‘synonyms’, as ‘intertwangled’, or as ‘the same thing’ (DIYbio discussion forum 2012/13). One author asked: ‘How about a merging of the articles “biopunk” and “biohacking,” with a redirect from biopunk to biohacking?’ (Ibid.). On the other hand, the point was also repeatedly made that biohacking and biopunk are
‘not interchangeable’, ‘should not be synonymous’, and that ‘[s]uffixes [such as] “-hacking” and “-punk” can have significant effects on discourse’ (Ibid.). In one post, the following proposal was made: ‘Biopunk’s article should discuss the fictional and real-world dimensions of offgrid/outlaw/antiestablishment biotechnology, Biohacking/DIYbio articles should concern themselves with activities, methods, individuals and events’ (Ibid.). In the end, no merger was made – ‘Anyway, I’ve taken down the “merge” tag for the biopunk article’, the penultimate post announces – and Wikipedia still has an entry on biopunk at the time of writing this article.

What are we to do with equality, comparability, and difference – these three possible relationships between biohacking and (bio)punk? Perhaps a better question to ask first is: what are we not to do in our analysis? Trying to ‘solve’ the comparison (by either choosing one relationship or trying to summarise all three of them) would not do justice to empirical complexity. One might also want to say that it is ‘ambiguous’ or ‘multiple’ or ‘contrasting’. But this would yield another problem – that of reducing three relationships by using one overarching qualification. What not to do, as Haraway pointed out, is to try ‘to “be” simultaneously in all, or wholly in any, of the […] positions’ (1988: 589), or, as Strathern (1991) reminds us, to seek ‘totality’.

So we know what not to do. But what (to ask the question again) are we to do analytically with these three relationships? What more can we say? The answer that I want to propose is that we need to ‘leave it there’. This English expression perfectly catches what we need to do analytically. We must refrain from any analytical move that would ‘bring us back’ to a central, singular, or total position; comparative moves do need to end. Like the end of a debate that does not lead to a consensus, we must recognise and accept that each side cannot be reconciled. We need to leave it there: talking about punks leads us into different directions and places, and we have to stay in these places. We need to stay ‘on the ground’ with the actors’ various comparisons, and try not to move to an analytical position ‘from above’ where we would say something different about these comparisons. I thus refrain here from trying to summarise or conclude the above comparison between biohacking and punk (and from trying to contain the preceding paragraphs in only a couple of words). I rather want to propose
a more modest move. While the comparison between biohacking and punk cannot be summarised in terms of its content, it can nevertheless lead to an insight regarding our methods: we sometimes need to ‘leave it there’.

**Comparison Three: Gentleman Amateurs**

The third comparison I turn to is the one between biohackers and amateurs. Let us start with anthropologist/STS scholar Chris Kelty, who writes in an article on ‘outlaw science’ and public participation that

> it helps to have a figure to work with in order to understand how our world is changing. Terms like ‘the public’ and ‘mainstream science’ mean very little to most people, but thinking with figures whose features bring out some aspects and hide others can be a much more revealing enterprise (2010:1).

The author goes on to argue that ‘Victorian gentleman scientists’ are one such figure. In a similar way, I write in a paper of mine that

> [i]n order to understand DIY biology historically, sociologically and techni-
> cally, we need to briefly come back to […] the place of amateurs in science (Meyer 2015: 143).

I also make this link in another article, arguing that there is a ‘long tradition’ of amateur involvement – and I take amateurs in natural history as an example (Ibid 2013: 119–20). So what do comparisons like this aim to do? In a nutshell, they provide a broader picture by historicising a specific phenomenon. This is one of the requirements of academic texts: that one must provide a ‘bigger picture’ and make reference to similar/comparable/related works.

Yet, despite the conventional nature of such comparisons in academic texts, what catches my eye here are expressions such as ‘it helps to’, ‘we need to’, and ‘we might gain’. Both cited texts pose comparability as evident: while there is
a claim for the legitimacy of a move between fields and times, the validity or partiality of this move is not problematised.

Other texts that have delved into the comparison between DIY biology and amateurs include a paper by historian of science Helen Curry (2013), and Sophia Roosth’s PhD (2010) in STS. Curry argues that both ‘share characteristics’ and that ‘parallels can be found’ (2013: 539, 563). Her text stresses likeness and historical continuity, while discontinuities and differences are not highlighted. Roosth, on the other hand, argues for a strict difference between DIY biology and amateurs: ‘Unlike Victorian gentlemen amateurs, biohackers do not pursue or promote science as a path to personal improvement or refinement, but as a pleasure and a kind of political speech’ (2010: 112). She further argues that the difference lies in ‘observation’ as opposed to ‘making new things, building, tinkering, modifying’ (Ibid. 119). Further arguments about discontinuity (as well as continuity) can be found in practitioners’ accounts. DIY biologist and informatics student Lisa Thalheim argues that

[a]mateur biology, in particular, is much older than biohacking or DIYBio. It’s a fairly different culture made up of fairly different people, and is rooted more in the Victorian idea of the ‘gentleman scientist’ rather than the 20th century’s hacker culture. I also don’t see flocks of amateur ornithologists and amateur entomologists scrambling to join up with the biohackers. Apart from the fact that amateur biology and biohacking have very different underpinnings – socially, historically, and culturally – I’d find it a little distasteful to unilaterally appropriate this culture (DIYbio discussion forum, 26 September 2012).

Other practitioners, when questioned about the role of the movement in the future of innovation, for instance, have said that DIY biology represents

[a] return to the ‘gentlemen scientists’ of the 19th century (Ibid 2013);

It creates freedom for innovators to work on their projects on their own time and try methods and techniques that may not be used by the established
industry. Science was perpetuated by amateur scientists [...] why can it not be continued by such? (Ibid 2013)

Moreover, Meredith Patterson, author of the *Biopunk Manifesto* (see above), argued:

> Western culture has a long and exciting tradition of talented amateurs contributing to the progress of science, and I hope people remember that we’re following in the steps of people like John James Audubon [...] as well as Edward Jenner [...] and [Jenner] was an amateur just like we are (interview with Patterson, cited in Anderson 2009).

Practitioners do provide historical readings about their own movement. A closer look at the suggested links with the history of amateur science shows that two slightly different arguments are made: while words such as ‘following’, ‘tradition’, or ‘continuing’ point to historical *continuity* (‘DIY history is full of citizen science’, as one person put it [DIYbio discussion forum, 2014]), talking of a ‘return’ and of getting innovation ‘back into our hands’ rather narrates a present that *reconnects* with the past. Practitioners’ self-definition and writing of history therefore needs to be considered in academic texts. Considering that academics (be they sociologists or historians of science) have the monopoly in making historical connections and disconnections, this would be at odds with the position (of symmetry) that I have chosen to adopt in this article. There is a similarity between the scholarly comparisons and the ones done by the practitioners cited in this section: both either argue that there are similarities and continuities between DIY biology and other amateur sciences, or that there are not – and both comparisons are ‘historicising’ ones.

Regarding my own research, I have come to realise that there is a discrepancy between the comparison I drew in my previous work (biohacking-amateurs) and the comparisons I had not made until now (all the others). Why was the comparison between biohacking and amateurs evident for me? Because I could thereby connect biohacking (which I have only recently started to
follow since 2011) to the theme of amateur science, a theme I am much more familiar with and that I have been working on for more than ten years. Amateur science therefore represents my own ‘comfort zone’ (see Strathern 2002). Thus, unsurprisingly, I have privileged this comparison at the expense of other comparisons (with terrorists and Steve Jobs, for instance). My third comparison leads me to a personal insight: I need to ‘get out more’… out of my own comfort zones.

Comparison Four: Terrorists

The fourth and final comparison that I want to discuss is the one between biohacking and terrorists. Both of these are not compared per se, but rather linked through a ‘hypothetical comparison’ (see Krause, this volume). Discussions frequently refer to terrorists when the potential risks and dangers of biohacking are examined. One of the writers for the journal Nature explains that the DIY biology movement ‘has been alternately hyped and decried as the solution to society’s ills or the nursery for a bioterrorist scourge’ (Ledford 2010: 652).

In a paper about biosecurity, legal scholar Brian Gorman reports about the ‘intentional threat from terrorists or criminals seeking to exploit the improved access to lethal biotechnology in garages or community based hacker spaces’ (2011: 426). Moreover, an article titled ‘Garage-lab Bugs: Spread of Bioscience increases Bioterrorism Risks’ reports that ‘[r]apid advances in bioscience are raising alarms among terrorism experts that amateur scientists will soon be able to gin up deadly pathogens for nefarious uses’ (Anonymous 2010).

The common line of reasoning is this one: biohacking opens up science and technology to non-professionals. Therefore, science can be used and misused by these non-scientists: if it falls into the wrong hands (such as terrorists), the consequences of this can be dramatic. The link with terrorists does one thing very clearly: it crystallises and epitomises the danger of biohacking. The figure of the terrorist is used to represent evilness and unpredictable danger in a clear-cut way. In contrast to the promissory comparison with Steve Jobs, the
comparison with terrorists is about threat. But like the comparison with Steve Jobs – producing the ‘yet-to-be-named’ individual – it also produces a vague, nameless social identity: the label of ‘bioterrorist’. The location of the figure of the terrorist (or, in a sense, its ‘geography’) is also interesting to be spelled out. The terrorist is a figure that occupies several places: it is articulated, above all, in the US and in Western countries; it is often used to refer to countries in the East; and unlike Steve Jobs’ ‘success story’ that can be easily localised, terrorists are portrayed as diffuse and potentially ‘everywhere’. Unlike Steve Jobs or Steve Wozniak (who are named and thus ‘singled out’), for example, the bioterrorist is never named.

These bioterrorists are not like the ‘gentleman’ amateurs seen above. And, unlike the complex punk-hacker relationship (which consists of equality, comparability, and difference), the only relationship that is asserted is avoidance. Whether it comes from public authorities or biohackers themselves, the message is the same: biohackers should not be equated with terrorists.

DIY biologists argue, for example, that ‘[b]ioterrorism is not a DIYBIO issue’ (Sassaman 2010); that ‘[b]oys will be boys; hackers will be hackers; and terrorists will be terrorists’ (eightpennies 2010); and that ‘nobody in the DIY community was interested in doing it – and if they were, then they were part of the bioterror community and not the DIYbio community’ (EJay 2012). Not only do they argue that there is a strict separation, they also argue that it is an unlikely association:

A terrorist doesn’t need to go to the DIYbio community. They can just enrol in their local community college’ (Patterson, quoted by Bryan Bishop, DIYbio discussion forum, 2008).

The idea of a terrorist somehow synthesising the next superbug is sort of beyond ‘kind of far-fetched’. I mean, say you were a terrorist – do you somehow acquire the incredible, field-leading technical know-how and facilities to actually custom-make an all-new superbug, or do you get a plane ticket to Africa and get some ebola, and then breathe on people’ (Bacter, DIYbio discussion forum 2011).
We need to mention here one famous story that has been widely circulated among biohackers: that of Steve Kurtz’s arrest. Kurtz is the founder of Critical Art Ensemble, as well as a university professor and artist who uses biotechnology in his artwork. One morning, in May 2004, he found his wife dead at home. He rang the police, who upon seeing his laboratory equipment and Petri dishes, called in the Joint Terrorism Task Force. The rest reads like a plot for a movie: the street was sealed off, agents in biohazard suits seized his equipment, and Kurtz was arrested and detained on suspicion of bioterrorism. It became quickly clear that his wife had died of natural causes, but it took four years for all of the charges against Kurtz to eventually be dropped. This story has been reported in biohacker circles and has become, in a sense, the opposite of a ‘success story’; Kurtz’s arrest and the charges against him represent a kind of worst-case scenario for any future relationship between biohackers and authorities like the FBI. As Ledford writes in her piece in *Nature*, ‘Biohackers are wary. They recall what happened to Steve Kurtz’ (2010: 651). In more recent years, the FBI has subsequently developed a more open and communicative attitude – presenting itself as the ‘new FBI’. For instance, at the FBI DIYbio outreach conference (organised in June 2012), the FBI declared that it ‘cares about’ and wants to ‘work with’ DIY biology practitioners, and that it sees them as ‘partners’ in a ‘positive relationship’. While repeatedly arguing that safety and responsibility were its main concerns, the FBI stated that its objectives were to be able to distinguish between ‘white hats’ and ‘black hats’ and to make sure the DIY bio community protects itself from ‘nefarious actors’.

The figure of the terrorist is used to draw a clear boundary between good and evil, and between security and danger. It maximises difference. Yet, while maximising difference it also qualifies a potential connection between hackers and terrorists: this is a connection to be watched, policed, and prevented – both by biohackers and by public authorities. In other words, the comparison between biohackers and terrorists is an ‘antonymic’ comparison that works through negativity and non-connection. Out of the four comparisons discussed in this chapter, it is the one that univocally states what biohackers should not be.
Having discussed these four comparisons, I want to come back and reflect upon the approach that I took. So far I have followed how, and to what, actors compare themselves. In the social sciences, such an approach has been promoted by various schools of thought. Ethnomethodological work, for example, seeks to capture how people make sense of the(ir) world, while actor-network theorists insist that we need to ‘follow the actors themselves’. I have been sympathetic to such approaches when I followed actors’ comparisons and I have been symmetrical as to whether these comparisons are right or wrong, plausible or implausible, or made by practitioners, journalists, or scholars. As such, the relationship between scholars’ and practitioners’ comparisons does not, at first sight, seem to be an issue. If we talk of a ‘relationship’ between both, we thereby suppose that there is a distinction to be made between actors and those who follow and study them; but this is arguably the opposite of what following the actors means. Following the actors thus also implies treating their comparisons as such, and not as mere analogies (or resemblances) or metaphors; that is, comparisons that are not literally applicable – or ‘undigested’, as Krause (this volume) calls them. There is an empirical and semantic reason for this: in the extracts quoted above, the actors have extensively used the verb be (i.e. ‘they are’, ‘will be’, ‘just like we are’, ‘is not’, ‘not to be’) along with terms like ‘the same thing’. Another reason is methodological: I consider that actors provide accurate and legitimate connections a priori through their comparisons, and I do not want to create an asymmetry by considering some comparisons as more ‘symbolic’, or less literal, or real, than others.

Without going into detail, we can list some of the benefits to an approach that follows the actors. First, it forces us to take practitioners seriously and to thoroughly examine their categories, their sense-making, and their knowledge claims. Second, it provides empirically-rich and grounded accounts of the worlds we study. Third, it helps us to move beyond predetermined frames and be open to potentially new and unexpected routes. Fourth, it prevents us from making normative judgements and from having to take sides.
But what if I had chosen *not* to follow actors so closely? What lies beyond the frame of this chapter? While a proper answer to these questions would require a paper on its own, it is worth providing a few clues. For instance, instead of using the bulky category of ‘the yet-to-be-named transformative individuals working in biology’, I might have crafted my own category in the section about Steve Jobs. Instead of abstaining to summarise and conclude the comparison between biohacking and punk (and ‘leaving it there’), I might have taken arguments ‘elsewhere’. Besides contending that there is a match between scholarly comparisons and practitioners concerning the similarities/differences between DIY biology and amateur sciences, I could have pointed to a discrepancy: that ‘on the ground’ both arguments are made but that scholars have only made one argument in their texts – and that they thus have not properly done their job. And finally, rather than presenting the comparison with terrorists as such, I could have ‘contextualised’ it by locating it much more in the US by arguing that it ‘sells well’ in media articles, and by arguing that practitioners might be naïve when dismissing it right away.

Since I have been symmetrical in my approach, I have not differentiated between arguments that were made in academic texts, internet forums, media reports, interviews, conferences, or blogs. The difference between sociology, history, journalism, and biohacking did not preoccupy me. I was also not concerned about the potential difference between the comparison with amateurs on the one hand (which can be ‘traced back’ and for which there should be ‘evidence’), and the comparisons with terrorists or Steve Jobs which are more speculative and not based on ‘evidence’ (but rather involve guesswork), on the other hand. Those unsympathetic to my approach would argue that what is missing here is context, critical distance, ‘hidden’ motives, and the ‘added value’ of sociological work.

In response to such criticisms, I would like to defend my position in three ways. First, fully developing a more critical and distant analysis would arguably require a paper on its own. It seems unlikely that within one paper, two different perspectives can be fully tried out. If we follow Haraway (1988), it is not possible to occupy two frames, two approaches, or two positions simultaneously when making knowledge claims. Our analysis is therefore necessarily
situated. Second, given my own methodological and theoretical preferences and choices, it would be very difficult for me to write from a position I have never occupied before – one that would be ‘above’ my material and provide a ‘contextualisation’, and one that would ignore that classical modes of contextualisation have routinely been criticised in STS and related disciplines (see Morita forthcoming). Third, ‘following actors themselves’ does not at all mean that sociological analysis and theorising thereby becomes impossible. Even though I have refrained from judging comparisons, I have still characterised them by calling them promissory, analytical, historicising, and antonymic. While I presented how people compare and to what they compare, I have also examined what these comparisons do in terms of identity. Rather than follow individual actors, I have followed how comparisons hold together different practices, places, and temporalities, and consider what these comparisons are supposed to produce, define or specify. And I not only listed four sets of comparisons, I also contrasted these comparisons amongst each other – something that is not done by the actors I study. In the empirical material presented we have seen comparisons being made, but these were not reflected upon and problematised in the way I have done in this paper. It therefore does make sense to talk about a relationship between scholarly and practitioners’ comparisons. While I did closely follow various actors’ comparisons, I also used new terms, provided additional comparisons, and juxtaposed various actors. While this paper is not substantially different from the empirical material of my case study, it nonetheless adds connections to this material.

**Conclusion: The Biohacker Multiple**

In this paper, I have discussed four sets of comparisons. These comparisons produce several outcomes. They render a new and unfamiliar identity more familiar, and thereby do ‘identity-work’. They do so by offering spatial, cultural, and temporal genealogies and frames of reference. In addition, such heterogeneous comparisons provide a variety of interpretational registers which are sometimes related, but are often also dualistic and oppositional. This, then, renders the
figure of biohackers as particularly intriguing, ambiguous, controversial, and discussable. In other words, such comparisons produce a ‘hot’ topic – one that is open in many ways to be flexibly interpreted, to be engaged with, to be questioned, to be contested, to be feared, or to be hailed. There are several reasons why biohacking has become such a ‘hot’ topic and why comparisons proliferate:

- it is a recent and emerging phenomenon;
- it provides good stories for media articles;
- it is a ‘fresh problem’, yet in need of established reference points (on ‘reference groups’ see Merton and Kitt 1950); and
- the identity of biohackers is multiple and uncertain, and the riskiness and innovativeness of their activities are up to debate.

Comparisons do at least two things: they do identity work, and they produce topicality. I would like to suggest that there is scope for further analyses of the performativity of comparisons. The following hypothesis can be made: while comparisons with amateurs and punks are potentially benign, comparisons with Steve Jobs are potentially lucrative, and the ones with terrorists are problematic. The threat of being linked to terrorists – and the ban, limitation, or policing of their activities – is perhaps the most performative comparison for biohackers. Further academic work could thus examine if the biohacker-terrorist comparison has had an impact on the establishment of the DIYbio code of ethics (first drafted in 2011), on the convening of meetings with the FBI (like the one in 2012), and/or on the writing of articles in response to negative portrayals in the media. Another topic could be to study how DIY biologists describe their activities as promissory and revolutionary – and compare them to known success stories in order to seek public funding or venture capital – and, at the same time, to find out whether funders ‘buy’ these promises.

While I discussed a seemingly single entity – biohackers – comparing them led me into many directions, spaces, and times. There is (at the end of these comparisons and in this conclusion) no ‘unity’ that can be constructed. Rather, these different comparisons co-exist (Mol 2011). Since these comparisons are multidimensional and refer to figures at varying scales and times, condensing
them does not seem to be an analytical option. Thus, while comparisons should
be ‘thick’, we need additional terms to help us to think about the co-existence of
these comparisons. The move towards analysing multiple comparisons (e.g. in a
conclusion), and trying to draw them together and produce coherent arguments,
should arguably be the opposite of ‘thick’ – if by thick we mean concentrated or
dense. Analyses and arguments about ‘thick’ comparisons should not condense
and summarise, but rather they should do the opposite: they should spread out
and ‘leave it there’. They should acknowledge vague and open social identities,
and diffuse and decentred geographies.

Rendering comparisons explicit and reflecting on my own work in terms
of comparison has yielded some new insights for me. In this paper, I did push
several comparisons much more than I did in the past. Although I encountered
them in my research, comparisons with terrorists and Steve Jobs, for instance,
had been totally absent in my writing. The comparison with punks was minimal.
The only comparison I did consider seriously was the one with amateur science.
My own comfort zone (the privileged position from where I draw my compari-
sions) has thus become manifest in writing this paper. One implication for my
own future work is that I need to be more explicit and reflexive about my own
frames, preferences, and silences when tracing some comparisons and not others.

I want to finish by stressing that scholars should openly and creatively engage
with comparisons. Comparisons need to be empirically traced and embraced
by the scholar/comparator. If the actors studied provide comparison (even
seemingly anachronistic and unlikely ones), scholars should closely follow such
practices of comparison themselves. They can and should follow what these
comparisons do and provoke, without a priori assessing their appropriateness.
The approach that I have adopted and defended here was to follow actors’ com-
parisons and to be symmetrical. Yet this still allowed me to provide an analysis
that characterised these comparisons, by reflecting upon, problematising,
juxtaposing, and contrasting them. The act of comparison is therefore useful
to ‘stretch’ scholars’ analytical arguments and scholarly positions in creative
ways. They ‘make explicit’ and raise productive questions about scholars’ own
comfort zones; about their relationship to both empirical material and theory,
and about their concerns when embarking on unanticipated routes.
ACKNOWLEDGEMENTS

Two un-anonymous referees, Monika Krause and Tereza Stöckelová, have provided incisive comments on an earlier version of this paper. Thanks are also due to Manuel Tironi and Jennifer Robinson for their remarks.

NOTES

1. Do-it-yourself biologists are also alternatively called biohackers – I therefore use both terms throughout this paper.

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