Conclusion: new horizons for innovation studies

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The chapters of this volume, at the crossroads of STS, economic sociology, sociology of consumption, rural sociology and the history and sociology of mobilisations, have led us to explore the multiple facets of these new horizons for innovation that are incentives to do *without* or *with less*. They led us to deepen and revisit reflections we formulated ten years ago [Goulet & Vinck, 2012], which have in the meantime been reworked by researchers who seized the opportunity. They have also enabled us to identify and explore new avenues of research. However, before introducing these elements of synthesis and openness, let us first return to the case studies covered in this book. Objects related to agriculture, livestock breeding and food occupy a prominent place in these reflections, alongside religion, energy, the chemical industry, paper bleaching, digital technologies, nuclear weapons, lamps, medicine, and health. Other areas could have been explored, such as detachment from connected objects, including mobile phones, that invade our daily lives [Jauréguiberry and Bonneville, 2007], the transport sector's commitment to removing polluting systems [Tironi, 2015], or alternative pedagogies advocating reduced intervention by the intermediary represented by the teacher [Wagnon, 2019]. A wide range of geographical areas are covered: Europe (France, Germany, England, Sweden, Switzerland), North America (USA, Canada), and South America (Argentina, Brazil, Canada), China, and Australia.

The first cross-cutting element in this conclusion is the fact that withdrawal is often associated with an ideal of purity. In his chapter, Benoît Godin reminds us that, unlike today, innovation has not always been idealised. During the Reformation in sixteenth-century England, it was even frowned upon, accompanied by a call for the withdrawal of theological and liturgical innovations, and a return to the past to regain a purity compromised by the introduction of innovations in the practice of worship or textual interpretation, 'man-made changes to God's word'. In the end, as B. Godin points out, "the reformer is not an innovator, but an orthodox".

This idea of reclaiming lost purity or balance is reflected in the idea of removing artefacts, artifices, actors and intermediaries that are ultimately not indispensable and may even prevent the 'natural' course of things. To do without vaccines or antibiotics would leave room for the natural expression of immunity, as Nicolas Fortané, Florence Hellec, Florence Beaugrand, Nathalie Joly and Mathilde Paul remind us in their contribution. Similarly, doing without the contraceptive pill, would make it possible to rediscover the body's natural rhythms, thanks in particular to the use of mobile phone applications [Grenfell & al., 2021]; managing with fewer interventions from the teacher in the classroom would enable the endogenous development of children and of their own capacities; doing without pesticides would make it possible to re-establish natural and ecosystem balances that would enable better regulation of the environment and reduce parasite pressure on crops; doing without advertising when surfing the web would make it possible to access content without being contaminated by unwanted messages. Withdrawing, doing *with less* or doing *without* would therefore be a step on the way to *letting* nature take its course, and rendering obsolete the need for certain technologies or the intervention of certain actors. In this line of thought, withdrawal, above all, aims to recover a certain original climax: nature needs nothing other than itself and should not be hindered, hence the idea of laissez-faire (of nature, but not of humans). This idea plays the role of a rational myth [Hatchuel, 1998] opposed to certain technologies, but also opposed to certain categories of actors or institutions including

intermediaries in the markets and teachers, among others. It is a question of removing mediation, which is always likely to deviate, divert, and betray the purity of origins and therefore to advocate the 'direct' or the immediate. The same phenomenon can be found in relation to books and their institutions (libraries, churches and universities), from which digital technology allows us to free ourselves in favour of more immediate access to knowledge, for unbound humanities [Vinck & Clivaz, 2014].

The fact of withdrawing something is also often linked to large-scale projects, anticipations, desirable worlds, and to a promise of difference [Le Velly, 2019]. On the scale of sociotechnical systems, Pierre-Benoît Joly, Bruno Turnheim and Marc Barbier emphasise that "*the discontinuation process is based on (or rather depends on) a dynamic of reciprocal reinforcement of the desirable and the possible, of the actors' anticipations and of the concretisation of socio-technical alternatives*". To withdraw is thus both to turn to the past to denounce progressively introduced entities, but also to look to a desirable future in which the order of things and beings will be 'better off'. The abolition of nuclear weapons analysed by Donald MacKenzie, is also defended as a way of maintaining the horizon of a liveable Earth: these technologies can lead to the eradication of whole parts of humanity. In the same line of thought, Laurence Monnais emphasises that the right not to be vaccinated, to hesitate, is sometimes defended in Quebec in response to deep sociohistorical logics, to sociotechnical imaginaries referring to questions as broad as the destiny or autonomy of a Nation.

A borderline case for thinking about these relations between past and present is the contribution of Léa Stiefel and Dominique Vinck. It invites us to consider the removal of things, of entities, which have not yet come into being in a project still in the preparatory stage, yet which are well established and dominant elsewhere, with the idea of centralisation as the inescapable solution for data management, with ERPs becoming the norm. At first glance, it may seem strange to remove an element that does not yet exist in a situation still under study, but that is so deeply rooted in our imagination, in technological promises, and in techno-managerial recommendations, that it is sometimes difficult to prevent its advent. The setting up of a centralised database or a single platform through which all transactions would pass perfectly fits these discourses driven by economic interests, but also by existing infrastructures or investments in progress which make their further development logical, justified, unquestionable and inevitable. They embody continuity, the normal course of events, and a certain idea of the autonomy of technological development. This is also the case of large-scale technological and infrastructure projects, such as the introduction of 5G, which lead citizens to try and get a technology withdrawn before it is even implemented.

When we talk about doing *with less* or doing *without*, the idea of withdrawal, of the eviction of something, obviously comes to mind. Zahar Korestky brings us the closely related notion of decline. He reviews the relevant literature to question the way in which the main currents of STS, transition studies or innovation studies tackle - or rather, fail to tackle - the mechanisms and drivers of decline. Indeed, decline is often left unaddressed, thereby benefitting the development and expansion of certain technologies. This call to think about decline as well as emergence reminds us not to be tempted by the other extreme, i.e. to think only about withdrawals and other declines. Indeed, several chapters in this book show that withdrawal is also associated with a rhetoric of addition: to enable withdrawal, to break links and detach, it is also a question of re-attaching and identifying alternative points of passage. The two processes coexist and feed each other, as shown by the X-curve which revisits the classics on the diffusion of innovations [Hebinck et al., 2022]. This book shows that, in practice, the

processes involved are much more subtle than simply removing or cutting links *versus* adding things or creating new links. Indeed, it is necessary to refine what we mean by removal. What the authors show in this book is that removal and addition are primarily transformative processes, the details of which need to be finely analysed. Addition (to which the idea of innovation is often reduced) and withdrawal are only simple in the mind. However, since Gabriel Tarde, innovation has been thought of primarily as a combination, an idea that can also be found in Joseph Schumpeter. The actors do not necessarily seek to completely sever existing links, as has been shown for instance, around innovations to shorten long food value chains, that establishing new links does not generally require breaking all pre-existing links [Le Velly, Goulet & Vinck, 2021]. Rather, it is a *quasi-detachment* that is underway with the withdrawal of intermediaries. Franck Cochoy, Cyrus Eugenio and Alexandre Mallard (in this book) show the same with regard to the withdrawal of packaging, which, at the time it was introduced, enabled the development of self-service: "*the cooperative promoters of organic products were going to push for the withdrawal of the packaging that brought about the self-service revolution, they were not ready to withdraw the self-service itself from the distribution scene*". L. Monnais also shows that *selection* and *hesitation* contribute to a form of partial withdrawal. Thomas Reverdy refers to the idea of *erasure*. And beyond partial withdrawal, using the case of agricultural pesticides in the contrasting situations of France and South America, Frédéric Goulet, Alexis Aulagnier and Matthieu Hubert introduce the question of the *intensity* of withdrawal, i.e., strong or weak. Due to contrasting problematisation of pesticides, more or less strong injunctions to withdraw emerge and lead to the framing and categorisation of legitimate alternatives. These authors show that in a situation of weak withdrawal, the scope of alternatives includes technologies that are part of the existing sociotechnical regime, and thus participate in a certain form of continuity. Finally, this is also illustrated by N. Baya-Laffite with the case of the polluting substances used to bleach paper pulp. By analysing the controversies surrounding the greater or lesser danger of certain substances, the author reveals how the more or less conservative positions of industrialists result in the defence of more or less ambitious alternatives.

There are thus many shades of detachment and withdrawal. The phenomena are just as varied and complex in the re-attachments and additions that occur and make detachments and withdrawals possible. The notion of re-arrangement is useful to describe such transformations, which go beyond outright withdrawal or substitution. The removal of packaging and the expansion of bulk sales thus involve the addition of a technology, gravity silos, and also a set of furniture for handling goods in bulk, with companies specialising in commercial furnishings. These furniture specialists demonstrate that certain economic actors play an essential role in the success of certain withdrawals by providing the keys and technologies required for this re-arrangement, as can also be seen in the example of alternatives to pesticides. An economy is created around the withdrawal processes; it refines the idea that withdrawal would necessarily undermine the economy linked to the incriminated technologies. Some actors may indeed be affected, but others emerge or reorient themselves; this is the example of the chemical pesticide industry analysed by F. Goulet et al., which now produces biopesticides using biological processes.

T. Reverdy's chapter invites us to reflect further on what the *less* and the *without* generate, and in particular how they can become sources of wealth creation and starting points for economic activities. As mentioned in the introduction, one characteristic of innovations based on withdrawal is that they are based on the almost paradoxical, or at least at first glance

surprising, fact of creating added value from a withdrawal. However, the conditions enabling the creation of this addition, like all those relating more broadly to the creation of value, are not self-evident. In this respect, T. Reverdy shows us that doing *without* or *with less* involves harbouring scarce resources, and that a value can therefore be attributed to them. He does this by studying the Negawatt movement and policies to encourage people to consume less electrical energy in France. He points out that the starting point for initiatives that have attributed a value to energy saved, not consumed, is that "*possibilities of not consuming are a potential source to be exploited, quantifying the energy that does not have to be produced*". He then shows that the principle of this approach is that "*the consumer who does not consume becomes a sort of producer since, by not consuming, they make available the electricity they should have consumed*", while examining in his chapter the difficulty of calculating the precise value of this new kind of "production", based on non-consumption. Doing *without* or *with less* and its promotion, thus implies complex phenomena have to be analysed, and T. Reverdy's contribution sheds light on one of these processes: the attribution of values involved in the withdrawal or the addition.

Withdrawal is therefore often not an easy task. Henri Boullier, in his work on the chemical industries' strategies in the face of the REACH regulation, and Nils Kessel, in his analysis of pharmaceutical firms' strategies to deal with – or anticipate – health scandals, show this clearly. H. Boullier highlights the resistance to withdrawal by industries, and how they "*manipulate regulatory mechanisms to their own advantage, so as to make toxic products 'legal'*". He identifies three main mechanisms: joint submission, the multiplication of derogatory measures, and substitution. The third mechanism is crucial, in particular reliance on new ways of categorising chemicals that "*keep 'old' innovations on the market*". This same logic of substitution can be found at the heart of the pharmaceutical industry's strategies, replacing incriminated molecules by others belonging to the same family, while maintaining a commercial product in whose marketing they have invested considerable sums. It can nevertheless be particularly risky, as pointed out by N. Kessel. Indeed, withdrawal, when it strikes following a scandal, "*rarely affect(s) a single product*". Through the interplay of products and their variants, "*which are more or less in competition with each other and substitutable, and whose development, marketing, regulatory classifications*" are closely linked, the banning of one molecule or one product can drag others down with it. The complexity of these processes also explains why, in some cases, withdrawal is the subject of a long-planned strategy, which is not necessarily, or at least not solely, a matter of reactive and hasty logic.

As pointed out by H. Boullier's contribution, the question of the categorisation of substances is in any case essential to be able to understand how certain substances persist or how alternatives emerge. The same question is asked by F. Goulet, A. Aulagnier and M. Hubert, who describe the way in which categorisation embodies the work carried out by the actors to redefine the perimeter that separates acceptable or legitimate technologies from those that are not, in terms of texts, regulations or opinion. Ultimately, technologies are neither good nor bad, nor should they simply disappear and others replace them; technologies are just more or less legitimate, depending on the time and the place. The boundary between the two is worked out by the actors involved who define what must and can be withdrawn or authorised, discriminated against, or encouraged.

This interplay of categories and their boundaries can have contrasting effects. In the case of the chemical industry, as H. Boullier points out, it "*may allow industries not to innovate, in the*

sense that their objective is mainly to maintain their 'old' products on the market. In this case, resistance to withdrawal does not lead the chemical industries to do without or with less, but rather to do as before." Moreover, it is also in the competition for the definition of 'good' alternatives that the resistance of industries is played out, as shown by N. Baya-Laffite in his chapter on pollution linked to the bleaching of paper pulp, with some of the less ambitious industrial players trying to impose the least ambitious alternatives possible, which will affect their activity as little as possible. In the case of pesticides and their alternatives, we can see how more or less strong withdrawal logics lead to the creation of categories of alternatives that are relatively hermetic to pesticides and, more broadly, to all the technologies specific to the dominant socio-technical system of intensive agriculture. This brings us to P-B. Joly, B. Turnheim and M. Barbier, who state that: "*incumbent actors may feel threatened and set up protective strategies in order to maintain the established sociotechnical order, even if it means that 'everything changes so that nothing changes'*". The withdrawal of a given technology does not necessarily mean that the regime as a whole changes, quite the contrary. This is what these authors show by revisiting the case study of no-till techniques, in which we had proposed the notion of innovation by withdrawal. The authors mention that "*we cannot extrapolate these processes from the study of product withdrawals. (...) withdrawals do not necessarily contribute to the discontinuation of socio-technical systems; on the contrary, they can contribute to its continuous adaptation and strengthening. It all depends on the destabilising effects and how these contribute to a dynamic of systemic change.*" N. Fortané et al. illustrate this observation with the reduction in the use of antibiotics; although recent policies in France in this area have produced convincing results, they do not in any way call into question the industrial livestock model, which, as a result, has been consolidated. This is also what [Vankeerberghen & Stassart, 2016] show, in another register, by emphasising that certain niches can be created in the form of insularisation within the dominant regime, based on specific withdrawals such as ploughing, without calling into question the dominant regime of industrial agriculture. This is also the case for the paper bleaching processes where one solution has become the new standard, meeting regulatory targets for the reduction of organochlorines, even though the 'Totally Chlorine Free' process continues to survive but remains as a green niche product for some markets where product labelling policies allowed fine differentiation. This is also highlighted in the chapter by Gay Hawkins and Anisah Madden, with the promise of the development of bioplastics and the bioeconomy, which certainly challenge the nature of the materials used, but by no means challenge a marketing and logistics model based on product packaging. The two authors thus invite us to pay more attention to the processes of problematisation, and to the way in which they determine the types of solution that are conceived and advocated. The contributions of P.B. Joly et al., N. Fortané et al. and G. Hawkins & A. Madden thus have the merit of inviting us to think about withdrawal in a more systemic way – withdrawal of an element within a model or system vs. withdrawal of the system itself –, which is in line with the idea of weak or strong withdrawal proposed by F. Goulet et al.

Jocelyne Pocher and Sébastien Mouret show that certain displacements and withdrawal dynamics can, in the long run and against all odds, take this systemic turn. These authors are explicitly interested in the dynamics of substitution, based on the case of animal products in food. They consider the logics of exclusion, eviction, and banishment of meat in human food, but also more broadly of livestock in agriculture. They adopt a socio-historical perspective and reveal how, in the long term, this logic evolved from hygienic vegetarianism linked to the American soya complex to, more recently, biotechnological innovations geared towards *in*

vitro meat or vegetable substitutes for meaty tastes, as part of a movement calling for the condemnation of industrial livestock farming. We thus have here a two-stage detachment: detachment from meat, and then detachment from livestock and farm animals. However, J. Porcher and S. Mouret warn of the excesses that can result from these systemic transformations, which risk leading to the eradication of animals on farms, taking with it animal labour and the rich and complex relationships between animals and humans.

In contrast to systemic and macro-level approaches, Grégori Akermann and Paul Coeurquetin's contribution examine detachment processes in more detail by looking at individual trajectories. These authors analyse the avoidance of gluten in the dietary practices of people who are gluten intolerant. They highlight the stages and resources called upon, whether cognitive, relational or dietary, in these eviction trajectories. One of the interests of this chapter is that it does not monitor the mechanisms of withdrawal by those who promote them, i.e., the translators or the innovators. Instead it presents the point of view of the user and his/her personal experience of a pathology, without getting caught up in the enterprise of an innovator who wants to bend fate and people's minds. In particular, the authors emphasise the period of questioning that preceded the diagnosis, the many hypotheses put forward and trials undergone, before gluten is finally identified as the element to be removed. Along the way, they gather the resources that led them to convince themselves that the problem is gluten and to gradually detach themselves from it. This period of meandering, which can sometimes extend over years, refers to the time steps identified in the contributions by H. Boullier and Nils Kessel, showing that it often takes years, sometimes even decades, before a substance is formally recognised as being harmful. While in the case of gluten, no resistance strategy on the part of industrialists has been identified (unlike, for example, salt in food [Déplaude, 2015]), it is the absence of knowledge and a stabilised frame of reference around this intolerance that delays the diagnosis.

Finally, some contributions take us into the realm of post-withdrawal, or at least what follows the decision to stop or end the use of a technology. Indeed, it is important to question not only what contributes to the withdrawal, reduction or phase out, but also what happens after these have begun. Peter Stegmaier asks us about 'maintenance in reverse': maintenance that would ensure not only that what has been done is maintained, but that what has been undone is not redone. This is what he calls the aftercare of discontinuation and dismantling, including management of alternative or replacement technologies, which are discussed in many other chapters. He shows the importance of paying attention to the activities that make it possible to 'stabilise destabilisation', and underlines how fragile the final exit is. In the same vein, on the subject of paper bleaching, N. Baya-Laffite shows that certain controversies can sometimes take a long time to die out, and sometimes even reignite under the effect of the doubt introduced by certain actors in order to rehabilitate technologies that have been left aside. D. MacKenzie also argues that none of the mechanisms for abolishing nuclear weapons ensure full control and avoid the risk of a crude nuclear weapon being built; he suggests that the abolition of nuclear weapons should be approached as a process involving the labs that worked on these weapons. Tacit knowledge is necessary to build a bomb and can be lost: if the required knowledge is not transmitted to a new generation of practitioners, it may die and be difficult to recreate. This kind of decline in terms of tacit knowledge leads to "uninvention" of the technology.

Peter Stegmaier takes us to the civil uses of nuclear power for energy purposes, and also fossil fuels such as coal, which are edifying examples of the difficulties involved in avoiding the

return of evicted technologies. In the light of the energy crisis that is shaking Europe in the early 21st century, some exits that seemed to have been decided upon are in fact compromised by the lack of alternative energy sources. These observations therefore invite us to think in the long term, and in a dynamic way, just as B. Godin invited us to do by taking us on a journey through the history of the very notion of innovation. Additions and withdrawals, declines and emergences, doing *without* or doing *with less* or *with more*, are processes that follow one another in time and are inseparable from one another.

In short, the contributions in this book enrich our understanding of the mechanisms at work in innovation processes, including decline, hesitation, phase out and withdrawal, among others. They sometimes concern individual preferences and practices, but can also be massive and may even be transformed into collective action, controversies, competing solutions, and conflicts. Conflicts regarding doing *without* or *with less* are frequent, but in some cases most of the points are in fact, not conflictual; the question is then to agree on an incremental solution that could solve the problem without requiring or involving a major breakthrough. In other cases, the conflict is severe and can be described as a war, because the innovation disrupts entire sectors of the economy. Doing *without* or *with less* is neither a simple nor a universal trajectory. Thus, the contributions in this book identify possible future research avenues. This is true of the variable value given to the introduction of novelties versus the withdrawal of certain entities, including forms of attributing economic value to resources that are no longer consumed. This also applies to the myths of a return to purified original forms and to the restoration of natural balances that should be left alone; to the processes of hesitation, learning and selection at the individual and/or collective and policy level; the role of anticipation, promises and even shared evidence which function as arguments for or against withdrawal with dynamics of reciprocal reinforcement of the possible, the desirable and the concretisation of effective alternatives; the rhetoric and practices of addition or new attachments which accompany withdrawal and detachment, as well as the processes of transformation and rearrangement; the variable intensity of these processes, which are often partial or very limited; the emergence of new actors, knowledge and skills, and new economies that support withdrawal or that it makes possible; strategies of resistance to withdrawal and/or diverting withdrawal mechanisms in favour of maintenance; processes of categorisation, delimitation and legitimisation or delegitimisation at work; the need to engage in systemic analysis of withdrawal processes which, sometimes, do not unsettle the sociotechnical system or, on the contrary, can disturb it to a greater extent than originally envisaged and take a systemic turn; or finally, the temporal dimensions of the processes, ranging from brutal destabilisation at the time of a scandal to temporalities that are ultimately very long: or the importance of paying attention to 'aftercare', to the aftermath of the dynamics that led to the *without* or *with less*, and to the twists and turns that never fail to occur.

With this series of mechanisms at work, it may be tempting to conceive of an articulation that would act as a general theory of innovation by withdrawal, to be tested systematically in a series of domains, thus initiating a cumulative research programme. In this order of idea, for example, it would be necessary to engage in systemic analyses that would enable the multiple connections that are experienced on the occasion of singular withdrawal processes to be better taken into account. Even more interesting are the questions identified by the contributors to this book and, above all, the connections between them, for example between forms of valorisation and forms of cutting, between mobilising myths and destabilising

established systems, or between new regimes established by withdrawal and the withdrawals of these withdrawals. Whatever the case, this collection of contributions underlines the importance of the phenomenon in our society, confronted with both the microscopic and planetary transformations it has brought about, and with the extent of the questioning that all this implies in terms of change and innovation.

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