

The Potential of Transdisciplinarity

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Introduction

Transdisciplinarity is a theme which resurfaces time and again. It responds to an underlying need and an inherent belief. The former is the loss to what is felt to have been a former unity of knowledge. The latter is the expectation that transdisciplinarity contributes to a joint problem solving that it is more than juxtaposition; more than laying one discipline along side another. As Francois Taddai puts it: “No discipline knows more than all disciplines”. If joint problem solving is the aim, then the means must provide for an integration of perspectives in the identification, formulation and resolution of what has to become a shared problem.

One virtue you need when working in transdisciplinary research: patience. You must be very patient indeed. The evidence clearly shows that developing transdisciplinary teaching takes time and commitment from both academics and institutions. To understand the language of other disciplines takes time. But you also need to understand where the pressure for joint problem solving comes from. Recent discussion has revealed that science and society are still being treated as unproblematic categories. In the two books which form the background for this presentation [*The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies* (with M. Gibbons, C. Limoges, S. Schwartzman, P. Scott, M. Trow) (1994). London: Sage, and *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty* (with Peter Scott und Michael Gibbons) (2001). Cambridge: Polity Press], we show that, in fact, they have both become problematic categories. Here I want to assert that knowledge, as well as expertise, is inherently transgressive. Nobody has anywhere succeeded for very long in containing knowledge. Knowledge seeps through institutions and structures like water through the pores of a membrane. Knowledge seeps in both directions, from science to society as well as from society to science. It seeps through institutions and from academia to and from the outside world. Transdisciplinarity is therefore about transgressing boundaries. Institutions still exist and have a function. Disciplines still exist and new ones arise continuously from interdisciplinary work. Therefore: beware!

Some characteristics of Mode-2 knowledge production

In previous research we put forward the proposition that a new form of knowledge production has emerged. We called it Mode-2. We introduced the idea of Mode-2 in order to bring in a new way of thinking about science, which is often described in strictly disciplinary terms. We need another language to describe what is happening in research. We identified some attributes of the new mode of knowledge production, which we think are empirically evident, and argued that, all together, they are integral or coherent enough to constitute something of a new form of production of knowledge.

The first attribute of Mode-2 is the fact that contemporary research is increasingly carried out in the context of application, that is, problems are formulated from the very beginning within a dialogue among a large number of different actors and their perspectives. The context is set by a process of communication between various stakeholders. That requires great patience. But the problem is not formulated outside of that group and until that group comes to an agreement about what the problem is and how it will be carried out, no resources flow and no research activity can begin.

The second attribute relates to the fact that multiple actors bring an essential heterogeneity of skills and expertise to the problem solving process. Also, in Mode-2 kind we see the emer-

gence of loose organisational structures, flat hierarchies, and open-ended chains of command. Universities are precisely the opposite type of such organisations. For the most part they are still highly hierarchical, fixed towards disciplinary structures. We find in Mode-2 almost the reverse of that.

The third attribute of Mode-2 is transdisciplinarity. If we had intended to use the term multidisciplinary or pluridisciplinarity, we would have done so. Rather, we have chosen transdisciplinarity for a reason. What we were trying to convey by the notion of transdisciplinarity is that, in Mode-2, a forum or platform is generated and it provides a distinctive focus for intellectual endeavour, and it may be quite different from the traditional disciplinary structure. In a Mode-1 system, the focus of intellectual endeavour, the source of the intellectually challenging problems, arises largely within disciplines. This may still go on, but other frameworks of intellectual activity are emerging which may not always be reducible to elements of the disciplinary structure. Rather, it is in the context of application that new lines of intellectual endeavour emerge and develop, so that one set of conversations and instrumentation in the context of application leads to another, and another, again and again.

In many discussions on transdisciplinarity, priority is given to the kind of obstacles that people engaged in transdisciplinarity have to confront. Prominent among them is distrust over questions of quality. Questions such as "Aren't you lowering the quality of what you are doing?" are frequently raised in relation to any kind of inter- or transdisciplinary activities.

Nonetheless, transdisciplinarity has a semantic appeal which differs from what one often calls inter- or multi-, or pluridisciplinarity. Note that the prefix - trans- is shared with another word, namely transgressiveness. Knowledge is transgressive and transdisciplinarity does not respect institutional boundaries. There is a kind of convergence or co-evolution between what is happening in the sphere of knowledge production and how societal institutions are developing. For example, we no longer are in the regime characterised by the grandiose type of nation state so characteristic of modernity, where there was a clearly structured, highly differentiated political, economic and social order with different functions that were taken up by the different sectors of society. What we see today is a resurgence, for instance, of NGOs and other ways in which various kinds of stakeholders organise in shaping social reality. This is why the transgressiveness of knowledge is better captured by the term transdisciplinarity.

There are two more important criteria of Mode-2 knowledge production: Accountability and quality control. Accountability differs from individual responsibility. While everyone should have an ethos of individual responsibility, it is necessary to have some sort of institutionalised responsibility, and this is what accountability in Mode-2 is all about. Accountability is an informal process but it has a formalised side to it. You know to whom you are accountable. There are certain procedures to make things visible that are otherwise invisible. And it brings in, different groups in society who want to know "what have you lately done for us?". It is this sense of accountability to different users that opens up the way to understand how scientific knowledge is being produced. Once there is awareness of accountability, and this has to become part of how future researchers are educated, then it can become a way to broaden the horizon of those for whom you are producing knowledge.

Quality control is indeed a very tricky criterion. In our first book, we readily admitted that in the way we described Mode-2 knowledge production, this is its Achilles' heel. Because what quality control in such a setting demands is not only scientific excellence. Scientific excellence is and remains the basis of producing good and reliable new knowledge. But there are other ingredients that go beyond scientific excellence in ways that are difficult to grasp because the context varies. There is no single criterion as there is in disciplinary quality control, where one can always fall back on the standards used in the discipline, allowing one to say: this is good physics. good biology. or good geology. You don't have this any more. And yet.

somehow, you have to bring in these additional criteria of quality, of value-added quality. Actually, we should go beyond value-added; we should start to speak about value-integrated. There is something of a societal value that needs to be integrated into the definition of good science. The potential of transdisciplinarity lies precisely here: to obtain a better outcome, to produce better science. We will see how we can get there.

Science and its contextualisation

In *Re-Thinking Science* we describe the co-evolutionary processes in which society and science are engaged. Co-evolution should not be taken to mean harmony. Transgression and the changing balance between State and Market are highly relevant themes. The unprecedented level of education in our societies, the pervasiveness of modern information and communication technology, the realization that the production of uncertainty is an inherent feature of the co-evolutionary process mean that Society is moving into a position where it is increasingly able to communicate its wishes, desires and fears to Science. What happens then to science as result of this reverse communication?

First of all, it is a portentous, and not a trivial, change. This has not been sufficiently grasped. Let me illustrate. We are familiar with the idea of science communicating with society. Much of the debate about the public understanding of science presumes that non-scientists are not really up to date with the latest developments of science and need to be informed. We expect that form of communication. We are used to descriptions in common sense terms of beautiful discoveries, of developments in instrumentation, and so on. But once you allow for transgression, once you allow that institutional boundaries have become fuzzy, you open science to a flow of reverse communications. This is what we meant, in *Re-Thinking Science*, by *contextualisation*. Generally, there is a failure to grasp that science is, by its very success, bringing in a transformative factor. This is furthered by a parallel loosening of institutional structures and by the fact that, when society has ways to communicate with science, science cannot expect to stay the same.

The term contextualisation may again sound different in different ears, but let me explain it in a very simple, but perhaps unexpected way, what we meant: contextualisation means bringing people into knowledge production by asking one question: "where is the place of people in our knowledge?". Taking contextualisation seriously means asking that question even in those areas of knowledge production that seemingly are far away from domains occupied by humans. Of course, you can see a long line of people, especially if you work in a field such as molecular biology, or when research has something to do with genetic diseases, or when clinics are involved. Yet, we maintain that simply asking such a question in every sphere of research will alter the way that knowledge is being produced and make us more aware that a process of contextualisation is going on.

Asking the question about the place of people in our knowledge also implies an additional dimension, namely that researchers move not only in the context of application, but that they need to start thinking about the context of implication. What are the implications of what we are doing, of formulating problems in this particular way? To stress the importance of the context of implication is not a call for new foresight exercises, the kinds of things that have been tried and go on now for a variety of different purposes. It calls for something much more radical, namely, to start asking this question in the scientific laboratories, while recognizing that the question will be answered in a variety of different ways.

People occur, so to speak, in different variants. In one variant, they are ordinary people whom you encounter every day. These people are not statistical averages. They are real people and they are becoming more and more part of scientific organisations. NGOs, for example, to co-

come back to an obvious example, depend for part of their funding on such people. This is also true for the research that some of the NGOs carry out. In the medical field, for instance, NGOs depend on funding that comes not only from the state, or from industry, but also from voluntary associations and private charities. So, in this variant, people are founders and supporters. They are loyal to science, but they want to have their say. People are *voice*.

In another variant, there are people who protest against what science or technology produces and which reaches them in what they consider unacceptable ways. Most European countries in the recent past have had their scandals, their crisis in public trust, their wave of protests and mobilization against something that science and technology, with the help of the market or the state, are offering them, but which they refuse. This is another way that real people come to influence the way in which scientific and technological development, as well as new regulations, take shape. This variant of people is on the verge of opting out. People *exit*.

There is still a third variant, that depends on the way in which people are conceptualised in the research process itself. This is obvious in some areas of science, as in the environmental field. You cannot do research on problems that have to do with the degradation of the natural environment without accounting for human intervention in these processes. But this should be interpreted to apply much more widely. Loyalty to science can no longer be taken for granted. It may simply vanish when people do not feel that they have a place in the knowledge which is being produced, allegedly for their benefit. Loyalty has to be earned, again and again. It has to be negotiated for. One way of doing so is to show that people are present, somehow - and be it only in an imaginary way - in the research process itself. People need to be made loyal again and again.

Thus, there are many different and, let me emphasise, legitimate ways of conceptualising people. You can imagine people in the abstract, as statistical aggregates. But, there are other questions that you might want to address for which it would be better to conceptualise people as active agents, people who have wishes, preferences, whose capacities can be enhanced and who interfere. We are arguing that you should be aware of this alternative in what you are doing, and make explicit which is the place you give to people in your production of knowledge. This is one way of tapping the potential of transdisciplinarity as well.

The production of *socially robust* knowledge

What are the consequences of the view that the boundaries between society and science have been truly transgressed on the traditional way we think about the demarcation between science and society? One of the implications of Mode-2, of course, is that it blurs and makes it harder to say where science ends and society begins. But, the whole epistemology that drives Mode-1 science is based on a very clear separation of science from society. Mode-1 epistemology is based on the idea of discrete areas of specialization structured on a model of communication that really has only two elements: the first one is that all research must be communicable in a form that can be understood by one's colleagues; and the second one is that it can attract a consensus, even if a limited one. Embedded in this model is a notion of reliable knowledge which comprises a whole series of relatively separate decisions about the integrity of a certain set of scientific findings, the limits of the integrity being dependent on the limits of the consensus achieved. Indeed, with the growth of specialization, many scientists agree that there is no overall consensus among the scientific community. There are only limited consenses held by groups of experts about where the consensus lies in their field of expertise. But in a regime where the line between science and society is being transgressed, how could this epistemology still guide us? Is it sufficient once people are drawn into the production of science? And, if not, what is the epistemology that will guide us? More provocatively: can we

find a way to move beyond merely reliable knowledge?

Reliable knowledge has served us well, and it is going to stay with us. Without the internal quality control of the peer group, science cannot be a sustainable enterprise because one needs a clear cut demarcation criterion: does it work or not? However, there are many more instances where reliable knowledge is no longer sufficient. The reaction of the public to the results of science are frequently contested. There are many controversies and there will be more to come, just because more educated people are also more critical, and society will continue to produce its own risks, since more options mean also more decisions to be taken. What we need is to strengthen by education people's critical abilities. We should be glad to have a highly educated and critical public to engage with in debate.

But what very often emerges when there is confrontation in the context of a controversy is that many researchers perceive the confrontation as an refutation of their work. It is a deep narcissistic insult to them because they work hard, and yet the result or the product - and it's good science, it's enthusiastic science, it is a beautiful piece of engineering ingenuity - is not sufficiently appreciated. It is refuted or contested. This is where our idea that something more is needed comes in. The answer we give (and it is an answer that needs to be filled out collectively, since there is no recipe about how to do it), is that what is needed in addition to reliable knowledge is socially robust knowledge. Robustness is a term that is familiar to engineers because some of them work on how to make buildings, for instance, more earthquake proof. Robustness is not an absolute concept, nor is it a relative concept either. It is a relational concept. To go back to engineering, robustness depends where your building is located. Is it an earthquake prone zone or not? What kind of material is being used and which is the function of the building?

To continue with the metaphor: we cannot predict where the next controversy in the confrontation with the public will arise. But we can be sure that there will be future controversies. And yet, somehow, we have to try to anticipate such controversies and those instances where the products of science and technology might be refused or contested.

Re-thinking science takes place in the *agora*

Thomas Hughes, the eminent American historian of technology, has shown, in his book *Rescuing Prometheus*, the change in ethos amongst engineers, particularly in the area concerned with finding solutions to complex problems. Over the last decades more and more inputs, including those from various pressure groups, have been brought to bear on the problem-formulation, design and completion of large-scale projects. That makes sense to us. But there is more to it. This ethos now has acquired a kind of feedback loop in that the engineers now realise that you get a better technical solution if you bring in these views. This is quite a revolutionary interpretation of transdisciplinarity. It implies that more involvement on the part of society means not a better social solution, or a better adapted solution, or one that brings social tranquillity to a community, but a better technical solution. Could not the same conclusion be applied right across the scientific spectrum: that better scientific solutions emerge if there is dialogue with society than if there is not? I suspect that many researchers would have an instinctive bias against this conclusion. Indeed, many would argue that social inclusion will give you weak solutions. The evidence presented by Hughes suggests otherwise.

By now, it is perfectly accepted and considered highly desirable across a wide spectrum of institutions, from industry to policy makers, that innovation and much of what is the thrust behind innovation, comes from new links between producers of knowledge and the so called users. But in order to fill the potential of transdisciplinarity, the notion of users must be extended. If knowledge is transgressive. then the whole range of reverse communications must

be opened.

What could be the appropriate structure in which a debate of this kind might take place? Going back to an old Greek term, we call it the agora. It requires the management of complexity in a public space, which is neither state, nor market, neither public, nor private, but all of this in different configurations. Indeed, the agora is everywhere. It is in your mind as much as in social or public political settings, in corporate structures or in the rules of governance as much as inside laboratories and how we relate to each other. It still recognizes disciplines, but it has moved beyond them to engage with - whom? - the imaginary layperson and imagined users, the public, citizens, in short, what we take to be society to whom we all belong.