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On The Aims And Responsibilities Of Science

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Abstract

I offer a view of the aims and responsibilities of science, and use it to analyze critically van Fraassen's view that 'objectifying inquiry' is fundamental to the nature of science.

> I see objectifying inquiry as the *sine qua non* of the development of modern science and its incredible, breathtaking achievements in our increasing knowledge of nature.
>
> Bas van Fraassen
> *The Empirical Stance*, p. 195

Van Fraassen claims that 'objectifying inquiry' is at the heart of modern scientific activity. I will explore the implications and credentials of this claim in the light of my views about the aims and responsibilities of science.

1. Science considered as a social phenomenon

The context for my argument is provided by five sets of propositions that, I maintain, should be taken into account in present day reflections on the aims and responsibilities of science. They point to some important features of science considered as a social phenomenon: outcomes of scientific activities (#1–3), traditional understandings about the character of scientific practices (#4), and recent changes in these understandings (#5).

#1. Modern science has produced, and continues to produce at an accelerating pace, an enormous stock of reliable knowledge and understanding of phenomena of the world, and of the processes, interactions, structures (and their components), and laws that its theories posit as underlying and pervading all phenomena. Moreover, a good deal of it has been used to inform countless efficacious applications in technology, medicine and elsewhere. These applications, which are widely valued positively, have

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contributed greatly to fundamentally transform the world we live in, by way of enhancing human powers to act, to innovate technologically, and to solve problems that hitherto had remained intractable.

#2. The current environmental crisis, with its (sometimes) devastating human and social dimensions, is among the consequences of certain kinds of scientific knowledge having been technologically applied under the socio-economic conditions that have been characteristic of modernity. Furthermore, science has not produced the knowledge that would be needed to deal adequately with this crisis, and it is only now clearly offering understanding of its extent, dimensions and probable causes.

#3. The benefits of applied science have not been distributed evenly among rich and poor peoples and countries — so much so that, under the socio-economic conditions of application, many poor people have suffered greatly from the disruption of their lives brought about by implementations of applied science, and (e.g.) the health problems of the poor have not been addressed by scientific research with the urgency that their severity would seem to demand. More generally, the problems of the poor have not shaped the priorities of applied science, and scientific "solutions" that are offered for them (e.g., for hunger and malnutrition) tend to be implemented without empirical analysis of their causal nexus, often leaving it in place and so failing to deal with the problems or even exacerbating the sufferings of the poor (Lacey 2005a, §8.3; 2006a, §3.3).

#4. The tradition of modern science has maintained that the practices of scientific research embody certain values (Lacey 1999; 2005a). One of them I call *impartiality*: a hypothesis becomes accepted as scientific knowledge only when it has been tested in the course of an appropriate rigorous program of empirical (often experimental) research and judged to be well supported by available empirical evidence in the light of strict cognitive criteria (e.g., empirical adequacy, explanatory and predictive power) that do not reflect particular ethical or social values. A second is *autonomy*: matters of scientific methodology and the criteria for evaluating scientific knowledge are outside of the purview of any ethical (religious, political, social, economic) outlook or personal preferences; the priorities of research, for the scientific enterprise as a whole, should not be shaped by a particular value outlook; and scientific institutions should be constituted so as to resist external (non-scientific) interference. Yet a third is *neutral-*

ity: scientific results, considered as a whole, do not support some ethical or social value outlooks at the expense of others, either by way of their logical implications or of their consequences on application.

#5. In our times, the socio-economic conditions of scientific research are rapidly changing. More and more, large technoscientific corporations and other commercial interests are funding scientific research, and government sponsored research increasingly tends to prioritize research that can be expected to have applications that will have reasonably short-term economic benefits. It is increasingly being said that with this change — towards 'private interest science' (Krimsky 2003) — the aims of science have changed. Certainly it is putting pressure on those who wish to uphold that the traditional values of science are still pertinent for engaging in scientific research; and, in doing so, it casts the responsibilities of science (i.e., of the scientific community, its institutions and organizations) into sharp relief.

2. The aim of scientific activity

Against the background of these propositions, I simply offer a proposal. The aim of scientific activity is (i) to generate and consolidate empirically grounded and well-confirmed *knowledge* and *understanding* of phenomena and (ii) to enable the *discovery* of novel phenomena and novel means for generating phenomena. The understanding sought is (iii) of increasingly greater ranges of phenomena, including phenomena brought about or sought for in the course of experimental and measurement operations (often for the sake of testing theories or informing technological innovations), in such a way that (iv) no phenomena of significance in human experience or practical social life — *and generally no propositions about phenomena* — are (in principle) excluded from the compass of scientific inquiry. Frequently (v) the activity is conducted with a view to the technological and other forms of practical *application* of the knowledge and discoveries that have been obtained.

Obviously, this proposal needs a lot of clarification, elaboration, and defense against the claims of alternatives (see Lacey 2005a, ch. 3; 2009). What is its status? The aim is not written into any code, and there is no binding manual of the rules that govern scientific activities. Moreover, there is not a clear consensus on what constitutes scientific activities (do they include the human sciences?) al-

though, within mainstream scientific institutions, there is little disagreement that a well-known range of activities should be considered exemplary. So, a statement of the aim of science cannot be simply descriptive. Neither can it be simply normative or legislated (whether on epistemological or ethical/social value grounds). It must represent an attempt to interpret the activities in which scientists — *qua* scientists — engage within a social practice, which unfolds historically; and to interpret the cognitive status and significance of the results of these activities and to provide a basis for appraisal (epistemological and ethical/social) of the 'scientific' activities that are actually engaged in. It straddles the fact/value (descriptive/normative) separation. It incorporates criteria for criticism, and endorsing an aim implies commitment to critique, to the pursuit of activities of certain kinds and, thus, to corresponding responsibilities. Given these features, the aim of science is always contestable, and open to change, and with changes of its aim will come changes in acknowledged responsibilities.

For now, however, I note only that item (i) can be easily amended to incorporate van Fraassen's condition on science, that "empirical evidence trumps all" (ES, p. 12; cf. p. 152), and that the aim so stated, like van Fraassen's 'empirical stance', does not tie science to any metaphysical position. Scientific activities, and their results, neither presuppose nor provide positive support for any metaphysical viewpoint; in particular, science is not tied to materialism or physicalism, or to the view that it is irrational to hold religious commitments (Lacey 2009). Likewise, the aim so stated leaves it open whether science brings just one methodological approach to investigation, or admits (in principle) of a pluralism of approaches, each adapted to the general features of the phenomena investigated in its field (Lacey 2005a, ch. 5). The proposal is intended to encompass the range of activities and approaches that go on in the institutions that are called 'scientific', while not necessarily excluding from the category of 'scientific' systematic empirical modes of inquiry, held to van Fraassen's condition, that may not be recognized as 'scientific' in the mainstream.[1] Individual scientists and institutions may contest this proposal, or they may articulate a variety of more specific aims, e.g., prioritizing differently the various components of the stated aim by putting greater or less emphasis on understanding or utility, or subordinating it to other interests (personal, military, corporate or financial). Those, who maintain that the aims of science have changed (#5), are likely to give high salience to items (v) and (ii) and to subordinate the other items to them, perhaps discounting item (iv) altogether.

3. Objectifying inquiry: distinct from *objective distancing* and *objective neutralizing*

Van Fraassen says: "I see objectifying inquiry as the *sine qua non* of the development of modern science and its, incredible, breathtaking achievements in our increasing knowledge of nature" (ES, p. 195). "Objectifying inquiry" — a kind of ideal rather than a description of actual scientific practice (p. 164) — involves, at its core: (1) the *pre-demarcation* of the domain of inquiry, relevant questions and the parameters in which they can be answered, and (2) the *acknowledged possibility of instructive defeat*, which is well served by the 'bottom line' objective to fit theoretical hypotheses to data models (p. 168–9).[2]

He elaborates: "The parameters chosen must be, *in a certain sense*, independent of who is doing the research" (p. 161, my italics), and "the disciplined relevant acts of observation [from which we obtain 'data models'] must register precisely what happens in the previously delimited terms" (p. 163). Then, theoretical hypotheses, also subject to constraints on admissible parameters, are acceptable provided that they *fit* the data models.[3] Moreover, once accepted, these theoretical parameters 'soon begin to affect the very structure and content of observation reports' (p. 163).

Van Fraassen distinguishes *objectifying inquiry* from *objective distancing* and *objective neutralization* (p. 160).

Objective distancing refers to a disciplined method of inquiry in which we take 'ourselves out of the picture' (p. 157), where an object is observed, preserved, measured, experimentally or clinically acted upon (we might say) 'just as an thing' or, in the case of a surgeon's practice, 'just as a body' as if the person were not present or his agency irrelevant.

Objective neutralization refers to ways in which we represent objects and phenomena (including in theories) as 'independent of human interests' (p. 158). I take this to mean that representing objects theoretically involves using categories that include no intentional, value or social contextual ones — or, put in positive terms, that, paradigmatically, phenomena are represented (modeled) in terms of how they, and the possibilities open to them, are derived from their hypothesized underlying structures (and their components), interactions among them and the processes they undergo, and the (mathematical) laws that govern these processes and interactions. It is pursuing objective neutralization in an all-encompassing way that leads to what Weber called a 'disenchanted' picture of nature, and Koyré

a 'devalued' one. The theoretical account of phenomena thereby offered is *value neutral* in the sense that it implies no value judgments. (It cannot, for its deploys no value categories.) But — anticipating a later argument — this does not mean that it is 'value neutral' in another sense, *viz.*, that its results are available to serve more or less evenhandedly projects favored by any viable extant interests (Lacey 2005a, p. 25–6; 2006a, p. 12–6). Although the 'neutral' theoretical representations *per se* may express no values and no interests, it might embody particular interests, and not universal values of humanity, that we engage in the activity of producing them and excluding other types of representations that do not represent phenomena in dissociation from their human and social contexts (Lacey 2005a, ch. 5; 2006a, p. 26–8).

Van Fraassen, noting that his account 'admittedly generalizes the quite special format of experiments and experimental result reports' (p. 165), asks whether it might not confine too much what we consider scientific inquiry to be. His answer is negative. He goes on, however, "*but such inquiry* [objectifying inquiry] *will still generally be thought of as not objective (even biased and subverted) if the practitioners ignore the strict disciple of objective distancing and the production of a factual value-neutral representation*" (p. 169, my italics).[4] Now, I have no doubt that objectifying inquiry, *which also incorporates objective distancing and objective neutralizing*, has produced an enormous amount of knowledge. It also has a kind of versatility and adaptability that ensures that it will continue to generate knowledge in ever more domains of inquiry. Furthermore, it is this knowledge that informs techno-scientific innovations and explains their efficacy, and enables their penetration into more and more domains of human life and social practice (#1). Nevertheless, I will now argue, it should not be taken to exhaust scientific or objective inquiry, as it usually is in private-interest science (#5), and when it is so taken, the scientific community fails to fulfill its responsibilities.

4. Two senses of objective distancing: *objective dislocating* and *objective detaching*

Van Fraassen's formulation of objective distancing, I suggest, fails to distinguish between (what I will call) *objective dislocating* and *objective detaching*. The former, but not the latter, goes hand in hand with objective neutralizing. When this distinction is made, it becomes possible to identify forms of objectifying inquiry that do not involve objective neutralizing and, thus, to interpret objectifying

inquiry (and science) as significantly admitting variety and as being consistent with methodological pluralism.[5]

Can we be more precise about the sense in which the parameters, which are pre-demarcated in objectifying inquiry, must be *independent of who is doing the research*? (I'll concentrate on observation.) Van Fraassen only says that it excludes 'certain forms of anthropocentrism or observer-centrism', and that it is not always the same thing as being measurable (p. 161). It involves, first, that observing that *x* has *p* is not dependent on the particular observer. It does not require, however, that *any observer at all* must be able to observe it or, if placed in the appropriate conditions, be able honestly to concur that *x* is *p*. This is most obvious in the case that an observer is deprived of the use of a sense. And, also, in the case that *p* represents a measurable property or a property detectable only instrumentally, the observer needs to be trained in the techniques of measurement and using the relevant instruments, and (normally) be fluent in the theories that underlie the techniques and the instruments. So, I'll put it: it requires an 'appropriately experienced (trained) observer' to observe that *x* is *p*, but observing that *x* is *p* is not dependent on any particular one of them. And I'll say that a parameter (used in observational reports) is 'independent of who is doing the research', if its applicability to an object could be decided by any appropriately experienced observer; and this usually goes hand in hand with inter-subjective agreement among these observers that appropriate statements, '*x* is *p*', should be included in the relevant data-model.[6]

Van Fraassen used the metaphor, 'taking ourselves out of the picture' (p. 157) to introduce the notion of 'objective distancing'. This metaphor permits two distinct interpretations. The *first* corresponds to when we *take things out of their 'natural' environments*, the environments we share with them in our daily lives, *and put them into environments within which human (intentional) causal factors are inoperative or suspended*. In a paradigm experiment, e.g., we observe and 'register precisely what happens in the previously delimited terms'. Furthermore, since human causation plays a role only in constructing the environment and instigating the initial conditions of the experiment, what is observed *happening in the environment* may be adequately described (for theoretical purposes) using only parameters linked with those consistent with objective neutralization. These parameters are successors of the categories that Galileo thought were needed to grasp the 'book of nature'. Here, we have indeed taken ourselves out of the picture — we are not there *inside* of what we are looking at; we take ourselves out of the picture by (as it were) changing the picture attended to and putting ob-

jects of interest for inquiry, but not ourselves, into the changed picture. This is the sense of objective distancing that I call '*objective dislocating*'. There is always a question of how knowledge pertaining to the behavior of objects in these environments can be extrapolated to their behavior — and certainly to its effects — in 'natural' environments or in the world of lived experience, a question that itself cannot always be answered by inquiry conducted solely under the condition of objective dislocating.

The *second* sense of objective distancing, the one I call '*objective detaching*', is a discipline that can be adopted when we observe phenomena in the world of lived experience, the world of social practices of daily life, in environments that we do not create and overseer, but only modify in the course of our interactions. We adopt this discipline when we observe what the phenomena are, reporting them with pre-determined categories, *putting aside our ethical judgments and emotional reactions*. We are not located outside of the spaces we are observing, but we put aside our stakes in what is happening, for the sake of distinguishing between what *is* the case and how we *would like* it to be (how it *should* be, how we value it). This is the discipline of the good social scientist (and the ecologist). It requires training and experience, and grasping well background assumptions of what factors may or may not be operative in a group, in a culture or whatever. It puts aside the observer's ethical judgments and emotional reactions, but that does not mean that ethical, emotional, intentional and social categories have no place in observational reports. Like theoretical categories, these ones too may 'affect the very structure and content of observation reports' — again, inter-subjectivity is a crucial constraint. We observe that 'she voted', that 'the board members decided to stop further risk studies', that 'he murdered his victim'. Special training, and even the cultivation of certain moral virtues,[7] may be necessary to be able to observe, in accordance with objective detaching, what actions members of a foreign culture or an opposed group are engaging in, for to observe what they are doing one must grasp their value structures and thus the kinds of intentions they act on and the social meanings they attach to them, and (often) learn the language in which they articulate (describe, plan, explain and justify) their actions. The price of not cultivating objective detaching is that one may see 'weapons of mass destruction' wherever one wants to find them, or not take seriously that a drug, which one has developed and hopes to profit from, may be causing harmful side-effects in patients.

Objective dislocating goes hand in hand with objective neutralizing, i.e., with representing phenomena in a causal (or lawful) order in a way that is independent of

human interests (disenchanted, devalued). As discussed above (in §3), this kind of representation is *value neutral*, in the sense that, since it lacks value categories, it has no entailments concerning value judgments. It also has no implicatures concerning them and so it provides no support, directly, for any value judgments. *Objective detaching*, however, *is not necessarily accompanied by objective neutralizing*. *Fit* of its 'data-models' may lack the precision and detail of fit of theories with data-models in the natural sciences, but it does serve as the 'bottom line' for appraising such hypotheses as:[8]

> The drug companies are being driven more by financial ambition and marketing considerations than by scientific or public health objectives, and *that* is the root of their current problems.
>
> The recently enacted legislation is the principal cause of increasing hunger and infant mortality.
>
> The risks of implementing technoscientific innovations pale into insignificance compared to the risks of 'being left behind' in the international economy or in contributing to scientific developments.[9]

Obviously the list could be extended indefinitely and into all sorts of domains. Note that all of these hypotheses *ceteris paribus* imply value judgments (the value judgments are not entailments but implicatures). E.g., it would be a practical contradiction to affirm that the recent legislation causes increasing infant mortality and, at the same time, to endorse it ethically *unless* one offered a mitigating explanation (Lacey 2006c). Inquiry that accords with objective detaching can be an instance of objectifying inquiry, although it is not value neutral in the sense embedded in objective neutralizing. I think that this is of utmost importance, if the scientific community to fulfill its responsibilities in adequately carrying out the full range of investigations that society might reasonably expect of it.

5. Objectifying inquiry, the '*decontextualized approach*', and the achievements of applied science

Let us go back a few steps. Van Fraassen is surely right about the thinking that pervades current scientific institutions, when he says (quoted in §3): '[objectifying inquiry] will still generally be thought of as not objective (even biased and subverted) if the practitioners ignore the strict disciple of objective distancing and the production of a factual value-neutral representation' (p. 169). In most

scientific institutions, inquiry that incorporates objective detaching is indeed dismissed as 'non-scientific' (or worse, 'biased and subverted' or 'ideological'). Furthermore, the dismissal carries the insinuation that inquiry, which incorporates objective detaching, must be defective in its cognitive credentials, unlike objectifying inquiry that incorporates objective dislocating (and neutralizing). I maintain, however, that if inquiry, incorporating objective detaching, is not to be included in the category of 'scientific', it is not because it must have inferior cognitive credentials.

I also quoted van Fraassen as saying: "I see objectifying inquiry as the *sine qua non* of the development of modern science and its, incredible, breathtaking achievements in our increasing knowledge of nature" (ES, p. 195). When he says this, especially because he uses the phrase, 'incredible, breathtaking achievements in our increasing knowledge of nature', I suspect that he is actually thinking of objectifying inquiry as incorporating objective dislocating and neutralizing (see note 5) — for I can think of no achievements that might be so described that derive from inquiry that incorporates objective detaching. Moreover, qualifying 'achievements in our increasing knowledge of nature' by 'incredible, breathless' make me uneasy — for, in current political and journalistic discourse, these adjectives are code for 'Don't criticize! Acting in a way that is informed by these achievements carries the mark of legitimacy on its sleeve'. When you are 'wowed' in this way you are not likely to practice the discipline of objective detaching.

Of course I don't deny these achievements (#1). But what does 'increasing knowledge of nature' mean? For van Fraassen it has no metaphysical implications. I take the phrase to be shorthand for something like 'increasing knowledge of an expanding class of (natural) phenomena and the structures, interaction, processes and laws pervading all phenomena'. Whatever nature is, however, we are part of it, and so are the social-ecological systems that shape the world of our lived experience: the polluted, devastated parts of this world (#2) as well as its ecological systems that are rich in biodiversity, and also the human beings whose lives have been shattered by poverty and military abuse (#3) as well as those for whom the texture of their lives is interlaced through and through with technoscientific objects and processes.[10]

As knowledge increases of a 'class of (natural) phenomena, and the structures, interaction, processes and laws pervading all phenomena', it leaves countless phenomena of other kinds that are of great significance for us untouched.[11] This knowledge is obtained from objectifying inquiry that incorporates objective dislocating (and also, therefore, neutralizing). I'll call it '*decontextualized knowl-*

edge' (cf. note 4) in order to avoid the potentially misleading connotations of 'knowledge of nature'. Decontextualized knowledge has also been widely applied *in* technological practices, and it informs the construction and functioning of countless technological objects and processes. It is the kind of knowledge that expands our capacity to exercise control upon objects in the world and, in doing so it has enabled (in combination with socio-economic forces) the huge transformation of the world of lived experience that we have witnessed over the past couple of centuries (#1), and *now* it is increasingly being put to the service of the leading institutions that are shaping the world's economic trajectory (#5).

This, I suggest, is the context in which to locate another (unelaborated) remark of van Fraassen's: "In science, the stakes are great for all of us: safety, food, shelter, communication, all the preconditions for life in peace and justice that a successful science can enhance" (ES, p. 15). Usually when, as they often do, newspapers, politicians and spokespersons of technoscientific corporations wax lyrical about the 'incredible, breathless' achievements of science, they have in mind scientific discoveries that have may some role in the social world that people readily grasp as valuable,[12] and as promising (perhaps with a bit of persuasion from advertising) to enhance their lives. Van Fraassen's focus is not on these practical achievements. The enthusiasm he expresses in ES is for the increasing knowledge of (as I have put it) a 'class of (natural) phenomena, and the structures, interaction, processes and laws pervading all phenomena' – developments of quantum mechanics and the like. But there would be little social support for the research that produces this knowledge, were it not for the applicability of much of it to phenomena that reflect the successes of applied science.

However, my juxtaposition of van Fraassen's remarks leads me to raise questions about the linkage between the achievements of objectifying inquiry that he celebrates, and enhancing the preconditions for 'life in peace and justice', which (I take it) are things presumed to be valued universally. Cannot those same achievements undermine (rather than enhance) these preconditions (#2 and #3)? Are they not, under the conditions in which research is conducted today, put more and more to the service of particular powerful interests (#5) rather than to enhancing these matters of universal value? What, then, are the conditions under which they could they enhance the latter? And, if the conditions are not at hand, what ethical and social significance should be accorded these achievements, and what does it imply for the responsibilities of the scientific community (cf. Kitcher 2001, Part II)?

There are few people who would deny that their lives have been enhanced by

some of them of the achievements of applied science in some way or other. Nevertheless, in the context of the social, political, economic, and military forces that have brought these successes into the world of lived experience, they (as utilized by the dominant forces) have also contributed to environmental devastation and an enormous amount of human suffering, and they have left in place or exacerbated the conditions in which most of the poorest people in the world live (#2, #3). This kind of science is not 'value neutral' in the key sense (the second sense mentioned in §3), since its results are not available to serve more or less evenhandedly projects served by any interests (Lacey 2005a, ch. 1; 2006a, Introduction). It is discordant with one of the traditional values of scientific practices, *neutrality* (#4). *The stakes are indeed high for all of us.* The benefits of applied science are accompanied by social costs. Is it true that (to date) the benefits outweigh the costs? It seems to me that the 'breathless' pursuit of technoscientific research and development, which is happening today, is legitimate only if there is good evidence to support that they do so. This is a question, I submit, like those raised in the previous paragraph, open to objectifying inquiry, but not of the kind that does not incorporate objective detaching, for it cannot leave consideration of socio-economic and ecological consequences and mechanisms out of the picture.

The kind of research (objectifying inquiry + objective dislocating + objective neutralizing) that leads to technoscientific innovations, as well as to the knowledge of nature that van Fraassen celebrates, cannot suffice to investigate phenomena pertinent to the legitimacy of socially and economically implementing an innovation. That research needs also objective detaching. Therefore, if scientific inquiry is considered to be that which produces decontextualized knowledge, it cannot produce knowledge that is needed to endorse the legitimating conditions of its applications (Lacey 2005a, Part II; 2006b).[13]

When research aiming to generate decontextualized knowledge is pursued 'breathlessly', application of its results is effectively guided by the ethical principle: 'normally, unless there exists scientific evidence that there are serious risks, it is legitimate to implement — *without delay* — efficacious applications of soundly confirmed scientific knowledge'.[14] This principle is reinforced by an *ethical imperative*, "prioritize technoscientific 'solutions' to the great problems facing the world, e.g., malnutrition in poor countries", combined with the insinuation that it is an *ethical deficiency*, not only to cast doubt on the legitimacy of research and development that might lead to such 'solutions', but also to propose that the investigation of risks should take into account the socioeconomic relations

involved in implementing the 'solutions'. Such an ethical outlook could be justified only by appealing to such hypotheses as 'technoscientific developments contribute to solving major problems facing the world', and 'for most problems there are only technoscientific solutions' (Lacey 2005a, p. 21–3) — hypotheses that, themselves, cannot be investigated in the kind of objectifying inquiry that leads to technoscientific innovations.[15]

Research aiming to generate decontextualized knowledge need not be pursued 'breathlessly', however. It can, e.g., be pursued in accordance with the Precautionary Principle (Lacey 2006b), which requires delays in the implementation of technoscientific innovations pending, case-by-case, the appraisal of their legitimacy. This appraisal requires — among other things, in addition to evidence of efficacy (which technoscientific research provides) and to standard risk analyses — the investigation of potential long-term environmental risks of an implementation, including those that may be occasioned by socio-economic mechanisms, and risks to social arrangements that arise from the actual context of their use, and whether there are alternative practices that promise greater benefits (Lacey 2005a, chs. 9, 10; 2006a, chs. 4, 5; 2007). Investigation that produces only decontextualized knowledge cannot (by itself) investigate these issues.

6. Concluding remarks

I built into my statement of the aim of science (§2) that 'no phenomena of significance in human experience or practical social life ... are (in principle) excluded from the compass of scientific inquiry' (item iv). Since some of the phenomena of significance for appraising the legitimacy of technoscientific applications cannot be investigated in objectifying inquiry that incorporates objective dislocating and neutralizing, science should not be limited to that form of inquiry. Or, *if it is*,[16] it cannot speak to the legitimacy of implementing the innovations that it makes possible — and, when its spokespersons do so, e.g., when they insist that there are no serious risks involved in using such technoscientific innovations as transgenics, they are putting their authority behind statements that have not been accepted in accordance with *impartiality* (#4), and abandoning *autonomy* (#4) for the sake of being of service to corporate interests (#5) that, in turn, provide funding for further technoscientific research.

The stakes are too high to conduct science without paying critical attention to the forces and relations of the production of scientific knowledge. It is of

little value to point to the potential of science to enhance 'the conditions for life in peace and justice' in an abstract way — and to celebrate the increasing knowledge being gained of a 'class of (natural) phenomena, and the structures, interaction, processes and laws pervading all phenomena' — if the predominant forces and relations of scientific production are subordinated principally to the values of capital and the market. Here it helps to keep in mind yet another remark of van Fraassen's: "Selectivity in science is deliberate, purposeful, and subject to evaluation as well. We ask not only if a given science provides accurate information about what it selected for attention, but whether it has selected well, whether it answers all or many important or relevant questions" (ES, p. 146).

This leads me to propose that it is irresponsible to engage in the kind of research — e.g., in biotechnology or nanotechnology — that leads to technoscientific innovations, *unless* systematic and rigorous research is also being conducted commensurately on the long-term ecological and social consequences (risks) of implementing them, taking into account the socio-economic conditions of the planned implementations, and *unless* adequate research pertinent to appraising the general social value (benefits) of the implementations (compared to potential alternatives) is conducted. This requires that the scientific community endorse the importance of objectifying inquiry that incorporates objective detaching, and thus doesn't limit science to objectifying inquiry that only incorporates objective dislocating and neutralizing. Put another way, in order to exercise its responsibility, the scientific community should be appropriately responsive to all of the components of the aim of science (as stated in §2), and (with reference to component (iv)) be particularly attentive to appraising the legitimacy of particular applications and *conducting whatever research that it may require* — on, e.g., side-effects (risks) and alternatives.[17] I believe that this is most likely to happen if major scientific organizations constantly urge that attention be given to the question: "how should scientific research be conducted so as to ensure that the integrity of nature might be respected and the well being of everyone everywhere enhanced?"[18]

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Resumo

Apresento uma concepção dos objetivos e responsabilidades da ciência, e a uso par analisar criticamente a concepção e van Fraassen de que a 'investigação objetificante' é fundamental para a natureza da ciência.

Palavras-chave
Objetivos da ciência, Bas van Fraassen, investigação objetificante, princípio precautório, abordagem descontextualizada, neutralidade.

Notes

[1] By stating the aim — or aims — in this way, I deliberately leave open many issues that engage philosophers of science. One may say that knowledge and understanding are expressed in *theories* but, given the more encompassing attitude that I encourage towards what counts as science, I take 'theories' to include any systematic presentation of knowledge and understanding held to the standard of impartiality (#4). How *knowledge* and *understanding* are to be construed is open, for I want neither to build empiricist or realist interpretations of theories (or any account of the confirmation or acceptance of theories) into the aim itself, nor to tie understanding to any particular account of models and their role in theories (on 'understanding', see Lacey 1999, p. 95–101), I refer to knowledge and understanding of *phenomena*, however, and not of *the world* (or 'the natural world', or 'the world we live in', or 'nature'). This is intended to endorse, as van Fraassen does, that theories are of delimited domains of phenomena, and not about some sort of totality or encompassing object.

[2] These two requirements correspond pretty closely to my own characterization of 'scientific' inquiry as conducted under a strategy and whose results are held to accord with *impartiality* (Lacey 1999; 2005a, ch. 1; 2006a, Introduction).

[3] Van Fraassen adds '(in various ways)' to 'fit', but does not elaborate. I take 'fit' to include a variety of cognitive values being well manifested in the light of available 'data models', and empirical adequacy is the most highly ranked of the cognitive values, and in the long run (to use van Fraassen's phrase) it 'trumps all'. Disagreements between van Fraassen and me on this point are irrelevant to my argument here.

What counts as a constraint on new parameters? Van Fraassen says (ES, p. 164) that it is closely tied to the immediately preceding history of the subject and that, in less fundamental sciences, parameters from an accepted more fundamental science should be used. It seems to me, however, that today the issue is not so much related the 'anomalies' of preceding theories, but to a whole range of phenomena left under-investigated — with enormous social cost. So why not consider the 'constraint': ability to grasp phenomena of practical importance?

[4] This corresponds to my referring to the privilege given to science, conducted within the decontextualized approach (Lacey 2006b; 2009 — see §5), or (in terminology that I used to use) conducted under materialist strategies (Lacey 2005a, sec. 1.3; 2006a, Introduction), and to the dismissal (that typically happens in the scientific mainstream) of inquiry conducted under strategies that do not fit into the decontextualized approach (and their results) as reflections of 'anti-science' motivations (Lacey 2005a, Chs. 5, 10; 2006a, chs. 2, 5).

[5] This corresponds to my claim that we can obtain results that accord with *impartiality* in research conducted under strategies that do not fit into the decontextualized approach

(Lacey 2005a, Part 1; 2006a, Introduction). Note that Van Fraassen insinuates, without elaboration, that the italicized statement in the previous paragraph does not express his own view, but I'm not confident that I've adequately grasped all of his remarks. Here I argue *only* that objectifying inquiry (characteristic of science) need not involve objective neutralizing. Whether or not there are forms of objectifying inquiry (outside of what would be called science) is beyond the purview of this article.

[6] Some modification is needed here to take into account the fact that so much research today (e.g., that involved in genomic analysis) is effectively automated, but this would not affect the main lines of the argument.

[7] To understand many phenomena of urban poverty, observations made during quick visits, or those lying behind publicly reported demographic data, do not suffice — for they cannot get at the value and intentional structures (and their variety) found among the urban poor people. These can only be observed following, and in the course of, intense accompaniment of the phenomena — and only those, who have cultivated certain moral virtues, are able to do this (Lacey 2005b). But this does not put into doubt the possibility of objective detaching in these circumstances, just as the necessity of having intense drive and unusual motivation is often essential for objective dislocating, engaging in experimental activities and being able to observe their results. Also, objective detaching does not mean that one does not have ethical reactions to what one observes, e.g., indignation, just as objective dislocating does not mean that emotions, e.g., exhilaration, will not accompany certain observations.

[8] There are many questions about 'fit' that I cannot discuss here; e.g., does it mean the same thing in the two types of inquiry? It might be said that we don't get good fit with data models in research held to objective detaching, or that we can't get high manifestations of empirical adequacy. Here arise a body of issues raised clearly by Richard Rudner years ago about the joint roles of cognitive and ethical values in endorsing whether or not certain judgments are sufficiently well supported for informing our actions (Lacey 2005c). These issues do not render the ideal of impartiality less pertinent or imply that we have to submit to special interests. Rather they point to the imperatives: don't close inquiry prematurely and also, according to me: follow the Precautionary Principle (Lacey 2006b).

[9] I read the first of these hypotheses recently in a medical journal, and the third is regularly cited to support certain proposals about what should be the research priorities supported by Brazilian scientific funding agencies.

[10] Terms like 'devastated' and 'shattered' have no place in inquiry that is held to being in accord with objective dislocating. Their use, however, enables more accurate description to be given of the phenomena in question and, thus, the kind of description needed for the sake of explaining them and taking a worthy stance in the face of them. Their use reflects the significance that the phenomena have for us, but that they have this

significance for us is a fact of nature; there is no good reason for those who aspire for comprehensive knowledge of nature to deny a place for these categories among the pre-demarcated ones that may be used (when investigating certain phenomena) for making scientific descriptions.

[11] Van Fraassen says that 'objectifying' involves both impoverishment and enrichment. I think that the distinction between objective dislocating and objective detaching helps to illuminate this point.

[12] E.g., curing disease — 'medical miracles'; or a new telecommunications device — the cell phone that 'makes life better', as an advertisement at São Paulo airport announces.

[13] If one endorses materialist metaphysics one might contest this claim (Lacey 2009). Van Fraassen does not.

[14] In several recent talks I have called this 'the principle of presupposing the legitimacy of technoscientific innovations'. Joachim Schummer (University of Darmstadt) has pointed out to me that a philosopher, Max More, has proposed the 'proactive principle' [http://www.extropy.org/proactionaryprinciple.htm], which incorporates much of the principle I state and its reinforcing proposals, and which is expressly intended to oppose the precautionary principle.

[15] On balance, has applied science caused more good than harm? *We don't know!* Think of cancer. There have been (within the decontextualized approach) 'breathtaking' advances in our understanding of cancer and its treatment. But I look out of my window in São Paulo, and see the thick brown cloud of pollution — and read about how it is increasing the incidence of cancer here. *So, what is the balance?* We don't know how applied science leads to increased incidence of cancer, and we can't know unless painstaking (and not 'breathtaking') research is conducted. We need the science that produces the cures; we also need the science that produces understanding of the causes, so that they can be addressed (but research that incorporates objective detaching in necessary for that).

In the case of food, I have argued that the potential of production using agoecological methods, compared with methods centrally informed by technscientific developments in biotechnology, has been vastly under-explored (Lacey 2005a, Part II; 2006a; 2007). Agroecology is informed by knowledge gained in research that embodies objective detaching as well as objective dislocating.

[16] My worry is that 'confining science' suggests superior cognitive credentials (in principle) to technoscientific knowledge compared to the knowledge needed for legitimacy. Then it is easy to say that we 'have' to take the risks — and this puts the connection betwen scientific knowledge and human welfare out of the domain of scientific inquiry.

[17] I think that the best way to interpret the Precautionary Principle is within the context of this view about the responsibility of the scientific community.

[18] Lecture presented at V Simpósio Internacional *Principia*, Florianópolis, Brazil, August 6–9, 2007.