

Better Safe than Sorry

Applying Philosophical Methods to the Debate on Risk and the Precautionary Principle

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Abstract

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The purpose of the present thesis is to apply philosophical methods to the ongoing debate of the precautionary principle, in order to illuminate this debate. The thesis consists of an Introduction and five papers. *Paper I* concerns an objection to the method of conceptual analysis, the Charge from Psychology. After a brief characterisation of conceptual analysis, I argue that the Charge from Psychology is misdirected. In *Paper II*, the method of conceptual analysis is applied to the concept of precaution which is analysed in terms of precautionary actions. The purpose is explicatory. A definition involving three necessary and jointly sufficient conditions is proposed, and the implications of this analysis for the debate on the precautionary principle are discussed. *Paper III* attempts to provide an analytical apparatus which may be used for finding improved formulations of the precautionary principle. The approach is lexicographical. Several existing and possible formulations of the precautionary principle are examined, and four common elements and a common structure of the precautionary principle are identified. It is suggested that the analytical apparatus presented can be used in negotiations of the precautionary principle. *Paper IV* questions the soundness of some arguments against the precautionary principle. Five common arguments are discussed and rejected. In *Paper V*, two of these arguments are further discussed. I argue that an attempt at rejection of the precautionary principle delivered by John Harris and Søren Holm is unwarranted, because their arguments against it are based on interpretations of the precautionary principle that ignore context. *Paper VI* deals with the idea of *de minimis* risk. After a discussion of the distinction between disregarding a risk and accepting it, I examine one way of determining *how* small a risk ought to be in order to be disregarded, namely the use of natural risk levels as benchmarks. I argue that this approach fails, even if the distinction between what is natural and what is not natural can be upheld.

Key words: Conceptual analysis, Precautionary principle, precaution, risk, risk management, *de minimis*

List of Papers

This doctoral thesis consists of the following Introduction and:

- I:** Sandin, P. Has Psychology Debunked Conceptual Analysis? *Metaphilosophy*, in press.
- II:** Sandin, P. The Precautionary Principle and the Concept of Precaution. *Environmental Values*, in press.
- III:** Sandin, P. (1999). Dimensions of the Precautionary Principle. *Human and Ecological Risk Assessment*, 5(5), 889–907.
- IV:** Sandin, P.; Peterson, M.; Hansson, S.O.; Rudén, C. and Juthe, A. (2002). Five Charges Against the Precautionary Principle. *Journal of Risk Research*, 5(4), 287–299.
- V:** Sandin, P. A Paradox out of Context: Harris and Holm on the Precautionary Principle. *Cambridge Quarterly of Health Care Ethics*, in press.
- VI:** Sandin, P. Naturalness and *De Minimis* Risk. *Environmental Ethics*, in press.

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Preface

In the summer of 1989, when I was nineteen, I spent a considerable amount of time trying to penetrate George Santayana's *The Sense of Beauty: Being the Outline of Aesthetic Theory*, which I had previously stolen from the school library. I thought it would help me to become a musician. Well, I guess it didn't. But what I remember is the mixed feeling of frustration and pleasure that came out of trying to understand the book. The lure of that feeling has never left me, and maybe Santayana's book is part of the reason why I now am in the process of, slowly, becoming a philosopher.

The writing of the present thesis has played an important role in this process. Of course, I have not got here single-handedly. Several people have assisted me in various ways in the preparation of this thesis.

First of all, I wish to express my gratitude to my supervisor, Professor Sven Ove Hansson, whose generous support and extremely helpful comments were essential in the writing of this work (and in many other respects as well). Without him, the present work would not be a worse thesis—it would be non-existent.

My sincere thanks are due to Drs. Martin Peterson and John Cantwell, who have spent considerable time and energy reading and commenting upon substantial parts of this thesis. My other colleagues at the Philosophy Unit have also generously aided me in different ways. Some of the papers in the thesis have been presented at conferences and seminars in different versions, where the participants provided many helpful comments.

Of course, none of these people should be held responsible in any way for my views or for my mistakes.

A few other people have also aided me in less academic ways. Rebecka Jansson is acknowledged for editorial assistance and, which is more important, constant love and support. Ulf Lundkvist deserves particular thanks for allowing me to use the illustration. My thanks also go to my parents, who supported me and never questioned my choice of career.

Last, and also least—but merely in the physical sense of the word—my son Algot has more than anyone else helped me to remember what is really important in life.

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Stockholm, 4 November 2004
Per Sandin

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Introduction

I am a rather keen taker of precautionary measures. Recently, I bought a kit containing a fire extinguisher, a portable smoke detector and a first-aid pack. Not that I ever expect to use them. But then, you never know. Fires, should they occur, might have horrendous consequences. Then again, they may not. But I don't want to risk it.

This thesis is about precaution, not primarily in everyday contexts like my purchasing a fire-extinguisher, but in questions of global concern: greenhouse-gas emissions, persistent organic pollutants, genetically modified organisms, and the like. I, for one, do not expect genetically modified organisms to pose a significant threat to the environment or human health. But, you never know. They might, just might, have absolutely horrible consequences. And that 'might' is the issue here.

The thesis is structured in the following way: I begin by stating the purposes of the thesis and argue for its relevance. Then I briefly introduce the precautionary principle and its historical background. This survey is followed by a commented summary of the papers included in the thesis. In the comments, I discuss some discrepancies between the papers and comment on some aspects not covered in the papers themselves.

Purposes and relevance

The overarching purpose of the present thesis is to investigate to what extent the ongoing debate on the precautionary principle can be illuminated by the application of philosophical methods. By 'illumination' I primarily mean enhanced clarity and explicitness. The purpose can be further specified as (i) to introduce the method of conceptual analysis and (ii) defend it against an objection, (iii) to analyse the everyday concept of precaution, (iv) to investigate the relevance of that analysis for the debate on the precautionary principle, (v) to provide an explication of the precautionary principle, and (vi) to evaluate the soundness of some common arguments against the precautionary principle, in order to (vii) defend the precaution-

ary principle against these objections, and (viii) further develop some themes encountered in that defence.

At the root of this lies, as the reader surely will notice, a dissatisfaction on my part with how this discussion has been conducted. Furthermore, there has been comparatively little written on the precautionary principle in the literature traditionally described as philosophical. An indication of this is that at the time of writing (September 2004) there are only ten hits for the phrase ‘precautionary principle’ in the database *Philosopher’s Index*.

To the extent a positive argument for the precautionary principle exists in the present thesis, it consists in refutations of counter arguments to the principle. There are at least four good reasons for a work in applied philosophy to take those arguments seriously, despite the fact that some of the arguments are rather simplistic in character.¹ (1) They are ubiquitous in the debate, and occur repeatedly over the years. (2) They are sometimes presented by people with considerable influence in policy questions. (3) They are not seldom presented as knock-down arguments. (4) Proponents of the precautionary principle have rarely responded to them in a systematic way, which might lead people to believe that the arguments have more force than they really have.

Another reason for my investigating the precautionary principle is that it is a well-established fact in many areas of national and international law and policy. I start with that and inquire into how it may be interpreted and, possibly, improved. Thus, if the reader so pleases, my arguments can be understood as conditional: *If* we are to apply the precautionary principle, *then* the conclusions presented here must be taken into account.

What is the precautionary principle?

Perhaps asking ‘what is the precautionary principle?’ is to phrase the question in the wrong way. As some would have it, ‘there is no such thing as “the” precautionary principle’ (Graham, 2000, p. 383). It is indeed true that the phrase ‘the precautionary principle’ has a multitude of uses, which I will try to clarify here.

First, ‘the precautionary principle’ refers to one or other principle of national or international law. Various precautionary principles, if I may use

¹ Several examples can be found in Morris (2000), reviewed by Sandin (2002). I do not claim that all arguments against the precautionary principle are simplistic. Some point at ways in which the precautionary principle should be further specified, but none is devastating.

the plural, have been included in several international legal documents.² Secondly, the phrase ‘the precautionary principle’ is used more broadly, referring to some principle that can be applied by decision-makers and policy-makers in general. This paper will be concerned with the precautionary principle in the latter sense.

The basic message of the precautionary principle in this sense is that on some occasions, measures against a possible hazard should be taken even if the available evidence does not suffice to treat the existence of that hazard as a scientifically established fact. In this sense, the precautionary principle is not necessarily a moral principle, but a principle for decision-making which can be justified either on moral or prudential grounds.³ I am aware that the distinction between prudence and morality is a traditional one which is not unquestionable. It should be noted that a few authors have in fact provided interpretations of the precautionary principle in terms of moral philosophy. Saner (2002) presents three main ethical traditions of the Western world and argues that they may account for the diverging interpretations of the precautionary principle. The three traditions can best be described as virtue ethics, deontological ethics, and consequentialism. (Saner uses a different terminology, however, and might have a broader conception in mind.) Karsten Klint Jensen (2002) sees the precautionary principle as an amendment to ‘the Liberal Principle’, that the only reason to restrict a person’s liberty by coercion is to prevent unacceptable harm to other entities worthy of protection.

Historical background

Several attempts have been made to trace the origins of the precautionary principle.⁴ These attempts fall into at least two categories. (The categories are not quite distinct.) Attempts in the *first* category assume a rather wide conception of the precautionary principle. An obvious example is Martin (1997). He writes:

The precautionary principle is an age-old concept. Unambiguous reference to precaution as a management guideline is found in the millennial oral tradition of Indigenous People of Eurasia, Africa, the Americas, Oceania and Australia. (p. 276)

² An extensive overview can be found in Trouwborst (2002), Annexes A, B, and C.

³ See, for instance, Haller (2000), cf. Harris and Holm (2002).

⁴ For some interesting examples, see Harremoës *et al* (2002).

Another example is a recent publication in which Dr John Snow's recommendation in 1854 to remove the handle of the Broad Street water pump in order to stop a cholera epidemic is cited as an early use of the precautionary principle. At the time, it was not proved beyond reasonable doubt that cholera was transmitted by polluted water, and the majority view among scientists was that cholera contamination was airborne (Harremoës *et al*, 2002, p. 5ff).⁵

Some writers find examples in regulation long before the term 'precautionary principle' appears on the scene. Nigel Haigh mentions the British Alkali Act of 1874, which 'required that emissions of noxious gases from certain plants should be prevented, using the best practicable means, without any need to demonstrate that the gases were actually causing harm in any particular case' (Haigh, 1994, p. 241). A more recent example is discussed by Martin (1997, p. 264):

The idea may first have appeared in the academic literature in the early 1950s under the guise of what was then called a 'safe minimum standard of conservation'.

An even more recent example is mentioned by Daniel Bodansky. Bodansky holds that '[i]n the United States, the precautionary principle underlay the first wave of federal environmental statutes in the 1970s' (Bodansky, 1994, p. 204).

I am somewhat sceptical to many of these attempts at tracing the origins of the precautionary principle. The reason is that while several of the cited examples are indeed examples of precaution, it is far from obvious that any *principle* of precaution was present when the action was carried out. For a principle to be present, we might demand that the agent as a minimum subscribes to a claim like 'precaution should be taken in situations of type *T*'. That the agent believes that precaution should be taken in the particular situation *S* is not sufficient. In addition, there must be a claim like 'precaution should be taken in situation *S* and *in relevantly similar situations*', with the relation of 'relevantly similar' somehow specified. Dr Snow, for instance, probably recommended a precautionary measure when he demanded that the handle of the cholera infested water pump be removed. But there is little support for the claim made by Harremoës *et al* (2002) that this was an early use of the precautionary principle.⁶

⁵ Reviewed by Sandin (2004).

⁶ Snow himself may have been rather convinced that cholera is transmitted via contaminated water. He had published on the subject previous to the Golden Square outbreak of 1854, and it is quite possible that he himself did not regard the removal of the pump handle as (merely) precautionary (Brody *et al*, 2000).

Attempts in the *second* category are more straightforward. They focus more on legal documents, and stay closer to the *term* ‘precautionary principle’ in the tracing of the ‘origins’ of the principle. The most comprehensive treatment in this category that I know of is Trouwborst (2002, Ch. 2).

One common claim in the literature, consistent with Trouwborst’s study, is that the precautionary principle first emerged in West German environmental law in the 1970s, under the name of *Vorsorgeprinzip* (Freestone, 1991; Boehmer-Christiansen, 1994; Cameron and Abouchar, 1996). It has been claimed that the ‘precautionary concept found its way into international law and policy as a result of German proposals made to the International North Sea Ministerial Conferences’ (Freestone and Hey, 1996, p. 4). According to Dommen (1993, p. 2), the precautionary principle ‘was first officially mentioned in the Ministerial Declaration of the Second International Conference on the Protection of the North Sea (1987) and fully stated in the Bergen Ministerial Declaration of May 1990’.

Kaiser (1997, p. 203) captures what seems to be a common idea about the precautionary principle today when he writes that ‘[p]robably the most influential statement of the Precautionary Principle we find in principle 15 of the Rio Declaration of 1992’. The text of principle 15 of the Rio Declaration is as follows:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (UNCED, 1993)

The English text of the Rio Declaration does not mention the word ‘principle’—according to one author, it has been ‘demoted to a “precautionary approach”’ (Dommen, 1993, p. 2). The official Swedish translation, however, gives ‘försiktighetsprincipen’, i.e. ‘the precautionary principle’. The same is true of several other languages.

In his contemporary account of the matter, Snow does not explicitly say that he actually recommended the removal of the pump handle, merely that after he had presented his case to the Board of Guardians of St. James’s parish, ‘[i]n consequence of what I said, the handle of the pump was removed on the following day’ (Snow, 1854, p. 322). Cf. Paper II.

The precautionary principle and decision theory

Perhaps surprisingly, comparatively few works in formal decision theory have been devoted to the precautionary principle. Among these few are Ready and Bishop (1991), Perrings (1991), Chisholm and Clarke (1993) and Hansson (1997). The most extensive decision-theoretical discussions are found in Hansson (1997) and Chisholm and Clarke (1993). All these interpretations take the assumedly risk-neutral strategy of maximising expected utility (MEU) to be the default rule in risk analysis, and regard the precautionary principle as more risk-averse. Taking expected utility as a starting point is not unreasonable. Cf. Schoemaker (1982, p. 529): ‘It is no exaggeration to consider expected utility theory the major paradigm in decision making since the Second World War.’

It can be questioned whether it is actually true that MEU is the default rule in risk management. One example, highly relevant for a discussion of the precautionary principle, is discussed by Hansson and Johannesson (1997, p. 164):

By far the most common approach in economic and decision-analytical studies of climate change is instead to base one’s calculations on the ‘most probable’ case presented by a scientific body such as the IPCC. This approach may be called the *maxiprobability method*. [my emphasis]⁷

Obviously, the maxiprobability method means that low-probability outcomes, including those with very severe consequences, are disregarded.

The attempts at formalising the precautionary principle that have been made include interpreting the precautionary principle as a risk-averse decision rule. Chisholm and Clarke interpret the precautionary principle as the minimax regret rule, while Hansson (in his 1997) interprets it as the maximin rule.⁸

There may be different reasons why the precautionary principle has rarely been discussed in terms of formal decision theory. One reason may be that the managers, lawyers, environmentalists and scientists who have discussed the precautionary principle have not been familiar with decision theory or have thought it irrelevant for practical matters. Similarly, decision theorists may have thought the precautionary principle irrelevant to internal problems of decision theory. Another possible reason is that decision theorists have studied the precautionary principle, but interpreted it as

⁷ A similar point is made by Prawitz (1980, p. 3) in his article (in Swedish) on rationality and nuclear power.

⁸ Hansson’s views are different in subsequent discussions. See, e.g. Sandin and Hansson (2002) or Hansson (1999).

examples of principles with more familiar names (such as ‘maximin’ in the case of Hansson, 1997).

Perhaps the most interesting of the possible reasons, however, is that while decision theory is usually concerned with choices among alternative courses of action, the precautionary principle, in many of its versions, is concerned with determining what alternatives are to be taken into account at all. That is to say that the precautionary principle can be interpreted as a transformative decision rule, a type of decision rules for which a theory only recently has been developed (Peterson, 2003). I think this interpretation is very reasonable.

Informally, a transformative decision rule is a decision rule that takes a decision problem as input, and yields a new decision problem as output. As examples of transformative decision rules, Peterson cites, besides the precautionary principle, the Principle of Insufficient Reason, Levi’s Condition of E-Admissibility, and *De Minimis*.⁹ It might be noted that the maximum probability method referred to by Hansson and Johannesson may also be interpreted as a transformative decision rule.

As an illustration, consider the case of a purely hypothetical version of the precautionary principle. Assume that this version forbids actions that might lead to a catastrophe, with a probability larger than some number ϵ . Furthermore, assume that there are three alternative actions a_1, a_2, a_3 , and three possible states s_1, s_2, s_3 . The decision problem can be expressed in the following decision matrix (Fig. 1):

	s_1	s_2	s_3
a_1	catastrophe ($p > \epsilon$)	bliss	bliss
a_2	bad	so-so	bliss
a_3	so-so	bad	good

Fig. 1.

If we apply our precautionary principle to this decision problem, we see that alternative a_1 is impermissible. Hence, when we have applied the precautionary principle, we have not yet received a recommendation on how to act, but our original decision problem will be transformed into a new one, which can be expressed in the matrix in Fig. 2 below.

⁹ For more on *de minimis* risk, see Paper VI.

	s_1	s_2	s_3
a_2	bad	so-so	bliss
a_3	so-so	bad	good

Fig. 2.

It is obvious from the example presented above that a precautionary principle interpreted in this way is in fact compatible with what is often regarded as the standard method in risk management, namely maximization of expected utility. Someone may argue that MEU should be applied only to those acts that are allowable according to the precautionary principle. In this respect, the precautionary principle is similar to how an insurance company would act: Insure as to maximize expected monetary value, but only if bankruptcy is not one of the possible outcomes.¹⁰

¹⁰ An early example of this way of reasoning in the context of environmental problems comes from the Swedish debate about nuclear power around the referendum in 1980. Prawitz (1980) argues for a version of what we today probably would call a precautionary principle, with explicit reference to the insurance business' principle of Maximum Probable Loss (MPL). His arguments are criticised by Tännsjö (1981).

Summary and Comments

In the following sections, I summarise the six papers and comment upon them. They have been published as separate articles, and are thus written as to be possible to read independently. I have reproduced them as they stand, and some repetition is therefore unavoidable. There are also some discrepancies between the papers, as my views have evolved on several points, some of which are elaborated in subsequent papers.

Methodologically, the present thesis is a somewhat heterogenous work. Throughout, however, I stick to what is traditionally termed analytical philosophy, and some methodological comments are offered below.

Paper I

Paper I is a contribution to the discussion on philosophical method. More precisely, it is a defence (not at all intended to be complete) of the method of conceptual analysis. (The term ‘method’ has a multitude of uses. Here I am using it interchangeably with ‘technique’.) By ‘conceptual analysis’ I mean the stock philosophical technique (to be distinguished from Conceptual Analysis as a movement) which Robert Audi has described as ‘an attempt to provide an illuminating set of necessary and sufficient conditions for the (correct) application of a concept’ (Audi, 1983, p. 90). Such sets are tested against intuitions by the use of hypothetical examples and thought experiments.

The philosophical method of conceptual analysis has been criticised on the grounds that empirical psychological research has cast severe doubt upon whether concepts exist in the form traditionally assumed. Therefore, it has been argued, conceptual analysis is doomed. I term this objection the *Charge from Psychology*. After a brief characterisation of conceptual analysis, I discuss the Charge from Psychology and argue that it is misdirected.

Other objections than the Charge from Psychology are not treated in Paper I. The most prominent of the objections I do not discuss is probably the one posed by the so-called paradox of analysis, which I will briefly de-

scribe here. By ‘the paradox of analysis’ I understand the idea that a typical philosophical analysis is either trivial or false.¹¹ A paradigmatic example of a philosophical analysis is ‘knowledge is justified true belief not essentially grounded in any falsehood’. (Let us for the sake of the argument assume that it is a correct analysis.) A less interesting but oft-quoted example is also ‘to be a brother is to be a male sibling’. Conceptual analyses have traditionally been expected to fulfil two criteria which were articulated by G.E. Moore (Cobb, 2001, p. 420):

The conceptuality criterion. The conceptuality criterion demands that analyses are about concepts or properties, not about expressions.

The identity criterion. The identity criterion demands that the concepts in the analysandum and the analysans be identical. Thus, the word or phrase expressing the analysandum must have the same meaning as the phrase expressing the analysans. The standard test for concept identity is the Frege-inspired interchangeability *salva veritate* in propositional attitude contexts (Ackerman, 1990).

Now we have the paradox: If the expressions in the analysandum and the analysans are identical in meaning, then the analysis states a mere identity. Consequently it is trivial. On the other hand, if the expressions are *not* identical in meaning, then the concepts in the analysandum and the analysans are different, and hence the analysis is false. As the purpose of conceptual analysis in the present thesis is explicatory (or reformatory), I have given up the identity criterion, and the paradox of analysis does thus not apply. I will therefore not dwell upon it any further here.

The purpose of conceptual analysis as I conceive it is *explicatory*. The ‘explication’ is Carnap’s (1951) and stands for transformation of an inexact concept—the *explicandum*—into an exact, or at least less inexact, concept—the *explicatum*. The idea is that the explicatum should be an improvement compared to the explicandum, while being similar (but not identical) to it.

Paper II

In Paper II, the method of conceptual analysis discussed in Paper I is applied to the concept of precaution. I analyse the concept of precaution in terms of precautionary actions. The purpose is explicatory, i.e. I attempt to present a clarifying definition of precautionary actions that is as consistent with current usage as possible. I proceed through checking proposed crite-

¹¹ For a different paradox of analysis, see Kuczynski (1998).

ria against linguistic intuitions with the aid of hypothetical examples. Distinctions between precaution and two related concepts, pessimism, and in particular prevention, are discussed. It is noted that despite seemingly near-synonymous, there are important distinctions between precaution and prevention, most notably that talking of precaution implies talk of actions. Taking precautions is something agents do, which is not necessarily the case with prevention. A definition involving three necessary and jointly sufficient conditions is proposed:

An action a is precautionary with respect to something undesirable x , if and only if

- (1) a is performed with the intention of preventing x
- (2) the agent does not believe it to be very probable that x will occur if a is not performed
- (3) the agent has externally good reasons for believing that x might occur, for believing that a will in fact at least contribute to the prevention of x , and for not believing it to be certain or highly probable that x will occur if a is not performed.

In the latter part of Paper II, the implications of this analysis for the debate on the precautionary principle are discussed.

Why precautionary actions?

In Paper II, I attempt to analyse the everyday concept of precaution in terms of necessary and sufficient conditions for an action to be precautionary. Why an *action*? Why not decisions? Why not persons? Perhaps, cautiousness is better thought of as a virtue than as something to be predicated about actions? Aristotle, for one, explicitly discusses courage as a virtue (or excellence, to use another translation).¹² It would, in fact, be quite possible to treat cautiousness as a virtue. I will return to this shortly.

When writing Paper II, my primary reason for choosing actions rather than decisions was what might be called analytical neatness. A person's being cautious and a decision's being precautionary can be analysed in terms of precautionary actions: A decision is precautionary *iff* it consists in choosing a precautionary action, and a person is cautious *iff* he or she typically performs precautionary actions. Thus, an analysis of precautionary actions, arguably, gives us the analysis of precautionary decisions and cau-

¹² *Nicomachean Ethics*, Book III.

tious persons as well. But, as will have struck the reader, the analysis could be reversed. A precautionary action could be defined as the action that a cautious person would have carried out.

I will merely sketch an approach to cautiousness as a possible virtue. In ‘Virtues and Vices’ Philippa Foot (1978) characterises virtues roughly in the following way:

- (i) Virtues are *beneficial characteristics* that a human being needs to have for his own sake and that of his fellows.
- (ii) They have to actually engage *the will*, and are thus to be distinguished from *skills*.
- (iii) They are *corrective*, in the sense that they are about what is difficult for humans in general (not necessarily for a particular individual).

Could cautiousness, taken as a character trait, show these characteristics?

Regarding (i), whether such a character trait is beneficial, the answer is probably yes. On most understandings of cautiousness, it seems that it would be beneficial to the cautious person and to his or her fellows.

Regarding (ii), we may apply Foot’s test for distinguishing virtues from skills (Foot, 1978, p. 169). Her point is that someone can choose not to exercise a skill, without leading us to conclude that the skill is lacking. Consider the skill of performing an eskimo roll. I possess that skill, but I may choose not to exercise it. I might, for instance, perform a failed roll in order to show my onlookers a common error. This does not count against my rolling skill. If someone accuses me of being a poor eskimo roller, the statement that ‘I did it deliberately’ rebuts the accusation. (Whether people believe me is another matter.) It is different with virtues. An accusation of lack of virtue can not be rebutted in this way. Suppose someone accuses me of lacking the virtue of courage (assuming that courage is a virtue). In this case, claiming that I deliberately failed to be courageous does not neutralise the accusation.

And what about cautiousness? Suppose Henriette deliberately performs an action which is contrary to cautiousness, say, steps out into a busy street pushing a pram without looking. (Here I am assuming that most of us have the idea that there is such a thing as cautiousness, and a common sense conception that the action just described is contrary to cautiousness.) I accuse Henriette of lacking cautiousness. She replies: ‘No, I did it deliberately’. Would that rebut my accusation? I am strongly inclined to say no. Thus, it seems that cautiousness does in fact display the characteristic (ii) of engaging the will.

Let us turn to (iii), whether cautiousness is *corrective*. Is it about what is difficult for humans in general? There is no straightforward answer to this question. There is no obvious corresponding temptation. In what way could being cautious be difficult? In at least two ways. First, being cautious does probably require some more thinking and planning than being non-cautious does. Arguably, a cautious person probably considers the available options and possible consequences more than someone not so disposed. Secondly, cautiousness might mean that some possible rewards are foregone in the interest of safety. The answer to the question whether cautiousness is corrective is thus probably yes.

It may well be that the virtue approach to cautiousness is promising. However, that investigation will have to be postponed for the time being. Another question is whether this approach is relevant for the precautionary principle. Virtues are notoriously difficult to apply in policy making.

Paper III

In Paper III, I turn to the precautionary principle itself. Paper III attempts to provide an analytical apparatus which may be used for finding improved formulations of the precautionary principle.

The method here is primarily *lexicographical*. I have surveyed several existing interpretations of the precautionary principle and attempted to find common elements and a common structure. The term ‘interpretations’ is appropriate here, as most of my examples come from the works of authors discussing the precautionary principle rather than from sources of law, such as legal documents, treaties and the like, although some do. The reason for this is that the main purpose of the thesis is the application of philosophical methods to the *debate* of the precautionary principle with the hope of illuminating that debate. I am not the only one to have taken this lexicographical approach to the precautionary principle; a very similar strategy is used by Manson (2002).

Several existing and possible formulations of the precautionary principle are examined, and four common elements (here called ‘dimensions’) of the precautionary principle are identified: (1) the threat dimension, (2) the uncertainty dimension, (3) the action dimension, and (4) the command dimension.¹³ It is argued that the precautionary principle can be recast into the following if-clause, containing these four dimensions:

¹³ In Paper V called ‘prescription dimension’.

If there is (1) a threat, which is (2) uncertain, *then* (3) some kind of action (4) is mandatory.

The phrases expressing these dimensions may vary in (a) precision and (b) strength. It is claimed that it is the dimension containing the weakest phrase that determines the strength of the entire principle. The same holds for precision: it is the dimension containing the least precise phrase that determines the overall precision of the principle. It is suggested that the four-dimensional if-clause be used as an analytical apparatus in negotiations of the precautionary principle. Paper III also contains an appendix with several different formulations of the precautionary principle. Paper III was the first of the papers to be written, and my views have evolved on several points. I will comment upon them below.

What type of actions does the principle prescribe?

The reader might already have noticed that there is a discrepancy between Paper II and Paper III. The model of the precautionary principle introduced in Paper III, containing the four core elements (dimensions) and the if-clause structure, does not explicitly require the actions to be precautionary in the sense discussed in Paper II. So what makes the principle precautionary? It should be mentioned that many of the formulations of the precautionary principle on which the analysis was built do in fact mention that the actions prescribed should be precautionary. This is true, for instance, of the Wingspread Statement on The Precautionary Principle (1998). Other formulations contain similar phrases. (See the phrases in the action dimension cited in Paper III, Appendix I.) In still other versions, it is implicitly assumed. The simple reason for the discrepancy between the two papers in this respect is that the analysis of the everyday concept of precaution of Paper II was not performed when Paper III was written.¹⁴ Therefore, Paper III should be read with that in mind.

Precaution and prevention

One point on which my reasoning was obviously incomplete in Paper III was the distinction between precaution and prevention. I treated the difference as one merely dependent upon the degree of uncertainty (p. 892f). However, there is more to it than that, and the claim that 'precaution might

¹⁴ One of the criteria in the analysis of Paper II is discussed to some extent in Paper III, namely the uncertainty criterion.

be regarded as a limiting case of prevention' (p. 893) seems simply wrong. There are at least three conspicuous differences: First, prevention is neutral with regard to value. Good things can be prevented as well as bad ones, while precaution is about avoiding something undesirable. Secondly, prevention implies certainty. Just as it is strange to say 'x caused y, but y did not happen', it would be strange to say 'x prevented y, but y happened nevertheless'. This is not the case with precaution. It is quite reasonable to say that in spite of all precautions, the unwanted event occurred nevertheless. Thirdly, talking of precaution implies talk of actions.¹⁵ Taking precautions is something agents do *intentionally*. This is not necessarily the case with prevention. Even inanimate objects may prevent things from happening, but they cannot take precautions. I have elaborated on the distinction between precaution and prevention in Paper II.

Argumentative and prescriptive versions

In Paper III, I also treated at least one important distinction rather cursorily. This is the distinction between argumentative and prescriptive versions of the precautionary principle. An example of an argumentative version of the precautionary principle is the one found in Principle 15 of the Rio Declaration (UNCED, 1993). It requires that 'lack of full scientific certainty shall not be used as a *reason* for postponing cost-effective measures to prevent environmental degradation' (my italics). Thus, it is not a substantial principle for decisions, but a principle for what arguments are valid. Prescriptive versions of the precautionary principle prescribe actions. One example is the so-called Wingspread Statement: 'When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically' (Raffensperger and Tickner, 1999, p. 354–355). It is prescriptive versions that are dealt with in Paper III. The distinction between prescriptive and argumentative versions is discussed in some further detail in Papers II and V.

Still, I must admit that my treatment of the argumentative versions of the precautionary principle is less than satisfactory. It would indeed be interesting to further discuss precautionary strategies in terms of *reasons*—some of the versions of the precautionary principle that I termed 'argumen-

¹⁵ By an action I here simply mean anything an agent does intentionally, including intentional omissions. This is a common position which I will tentatively accept. I am not unaware of the problems with this position, but an investigation is beyond the scope of the present thesis.

tative' are in fact more about reasons than about arguments. This, however, will have to be a task for future research.

Degree of stringency

Another problem that was less than satisfactorily treated in Paper III was the degree of stringency of a formulation of the precautionary principle. In Paper III I used the term 'strength'. Here I will substitute 'stringency'. The reason is that the relationship between strength in the logical sense and the degree of stringency of a formulation of the precautionary principle is not straightforward.

There are three ways in which one formulation P of the precautionary principle may be more stringent than another formulation Q. First, P may prescribe precautionary action in every case that Q does and at least one additional case.¹⁶ Secondly, P may prescribe more extensive action than Q does. Thirdly, P might prescribe the action in a more demanding way than Q does, for instance by saying that the action is mandatory rather than merely desirable. Let us put this somewhat more formally, and define the relation 'at least as stringent as' that holds between two formulations of the precautionary principle:

A formulation P of the precautionary principle is, *ceteris paribus*, at least as stringent as a formulation Q of the precautionary principle, if

- (1) the set W of situations in which precautionary action is prescribed by Q is a subset of the set X of situations in which precautionary action is prescribed by P; or
- (2) the action prescribed by P is at least as extensive as the action prescribed by Q; or
- (3) the prescription expressed in the command dimension of P is at least as demanding as the corresponding prescription expressed in Q.

We can now define the relation 'more stringent than' in terms of the above 'at least as stringent as' in the following manner:

¹⁶ It is obvious that the degree of stringency is highly sensitive to the framing of the decision problem to which the principle is applied, i.e. what threats are considered. This is elaborated on in Paper IV.

A formulation P of the precautionary principle is *more stringent* than a formulation Q of the precautionary principle, if and only if P is at least as stringent as Q, and Q is not at least as stringent as P.

It must be noted that the definitions above are not complete. The incompleteness is reflected in the use of the phrase '*ceteris paribus*' in the definition of the relation 'at least as stringent as'. It is not clear what happens if we, for instance, have two formulations X and Y, where X expresses a more demanding prescription than Y, but Y prescribes more extensive action than X.

In the following, I will use the term 'stringency-increasing' for the operation of substituting a phrase which contributes to making a formulation of the precautionary principle more stringent. Conversely, I will use the term 'stringency-decreasing' for the operation of substituting a phrase which contributes to making a formulation less stringent. Let us now consider what makes the substitution of a phrase in one of the dimensions stringency-increasing or stringency-decreasing.

In the action dimension, a stringency-increasing operation is the substitution of a phrase implying *more extensive* action. Often, it is intuitively clear what is meant by 'extensive'. I take it that the more extensive action is the one with the most far-reaching effects, if the effects were known with reasonable certainty.

In the uncertainty dimension, a stringency-increasing operation is the substitution of a phrase demanding less certainty for a phrase demanding more certainty.

In the command dimension, a stringency-increasing operation is the substitution of a more demanding phrase for a less demanding one. For instance, the substitution of 'should be taken' for 'may be taken' would be stringency-increasing. Most formulations seem to contain intermediately demanding phrases, though it is not always entirely clear which phrase is the most demanding. In the literature, we find phrases like 'should be taken', 'is required' and 'is justified'. They can be more or less demanding. (A thorough discussion of this, or what one author calls 'bidding strength', is found in Guendling, 1974.) The following passage from Olivier Godard illustrates how prescriptions may be more or less demanding in the context of the precautionary principle:

[I]t may be justifiable (weak version) or [it is] mandatory (strong version) to limit, regulate, or prevent potentially dangerous actions before scientific proof is established (cit. in Martin, 1997, p. 266).

Many formulations of the precautionary principle use various expressions containing the verb 'should'. Following Guendling (1974, p. 120), we may

say that ‘should’ and ‘ought’ are equally demanding, while less demanding than ‘must’ but more demanding than ‘may’. The formulations using ‘should’ can thus be said to be intermediately demanding.

The formulations using ‘should’ go well with a legalistic or ethical interpretation of the precautionary principle, i.e. the command is taken as a legal or moral imperative. There are, however, at least two other possible interpretations, on which I shall briefly comment. The first interpretation is to take the precautionary principle to be a value proposition, stating that precautionary action is good (or better than inaction).¹⁷ A clear formulation is found in Myers (1993), who writes:

In essence, the precautionary principle asserts that *there is a premium on a cautious and conservative approach to human interventions in environmental sectors that are (a) unusually short on scientific understanding, and (b) unusually susceptible to significant injury, especially irreversible injury* (p. 74, italics mine).

On the other interpretation, the precautionary principle is neither a prescription of the ‘should’ type nor a value proposition, but a statement of what actions are *justified*. We find this in Cameron and Wade-Gery (1995). They write:

[(1)] The precautionary principle stipulates that where the environmental risks being run by regulatory inaction are in some way (a) uncertain but (b) non-negligible, regulatory inaction is unjustified (p. 100).

This interpretation is not implausible. However, there seems to be some confusion as to what the double negation (*inaction* and *unjustified*) means. For as a ‘more stringent version of this basic formulation’, they give:

[(2)] The precautionary principle stipulates that where the environmental risks being run by regulatory inaction are in some way (a) uncertain, but (b) non-negligible, regulatory action is justified (p. 135, footnote 24).

It is not obvious that (2) is more stringent than (1). For, if (2) is to be more stringent in this context than (1), it is a reasonable interpretation that (2) should entail (1). Let *a* be an action and let *Ja* stand for ‘*a* is justified’. Then we have

(1) $J \rightarrow a$

(2) *Ja*

and the stringency criterion:

¹⁷ For more on this, see Paper IV.

(3) $Ja \rightarrow \neg J\neg a$

However, (3) is equivalent to

(4) $\neg(Ja \wedge J\neg a)$

which is clearly counterintuitive, as it would mean that it could not be the case that both acting and not acting is justified. And we can easily construe such a situation: for instance, if there are equally good reasons for implementing and not implementing a policy (e.g. both alternatives lead to desirable consequences), then both implementing and not implementing the policy can be said to be justified.

As we noted above, the phrase '*ceterus paribus*' is of central importance. We saw that if we carry out a stringency-increasing operation in one dimension, the degree of stringency of the formulation increases—provided that the other dimensions are not tampered with. Now let us study how the relation between the dimensions might affect the degree of stringency of a formulation. In Paper II, I argued in the following way. Consider the following hypothetical formulation of the precautionary principle:

If there is (1) a possible threat to the environment, no matter how insignificant, which is (2) not regarded as completely impossible by all rational individuals, *then* (3) any action which may avoid or mitigate the threat (4) is mandatory.

This formulation is extreme, and probably no one would propose it seriously. (Compare the argument from absolutism, discussed in Papers II, IV and V.) Nevertheless, this extreme formulation is a useful starting point for illustrating what happens if we substitute other phrases in each dimension, one at a time, such that the substitution is stringency-decreasing (the substituted phrases are in bold type):

If there is (1') **a threat to the existence of all present and future life in the universe**, which is (2) not regarded as completely impossible by all rational individuals, *then* (3) any action which may avoid or mitigate the threat (4) is mandatory.

If there is (1) a possible threat to the environment, no matter how insignificant, which is (2') **extremely plausible according to all acknowledged scientific experts**, *then* (3) any action which may avoid or mitigate the threat (4) is mandatory.

If there is (1) a possible threat to the environment, no matter how insignificant, which is (2) not regarded as completely impossible by all rational individuals, *then* (3') **preventive measures that are profitable in their own right** (4) are mandatory.

If there is (1) a possible threat to the environment, no matter how insignificant, which is (2) not regarded as completely impossible by all rational individuals, *then* (3) any action which may avoid or mitigate the threat (4') **may be acceptable**.

Arguably, neither of the four modified formulations is very stringent. The first formulation demands unreasonably severe damage in order to trigger precaution, while the second formulation demands that the scientific uncertainty is unreasonably small before precaution is triggered. The third formulation prescribes action that would have been carried out anyway, which amounts to prescribing nothing. The fourth formulation is not very stringent because the prescription is a non-committal one.

In Paper III, I claimed that these examples show that it is the dimension containing the least stringent phrase that determines the stringency of the entire principle. This claim seems exaggerated, and I would today put it differently: If *one* of the dimensions contains a phrase the substitution of which is enough stringency-decreasing, the whole formulation is rendered non-stringent. Put another way, there seems to be a *minimum level* for each dimension. If one of the dimensions is below a certain level, then that cannot be compensated by stringency-increasing substitutions of phrases in the other dimensions (as is indicated by the examples above).

Paper IV

The precautionary principle is not without critics. Paper IV, which was written in co-operation with my colleagues at the Philosophy Unit, Martin Peterson, Sven Ove Hansson, Christina Rudén and André Juthe,¹⁸ is an attempt to evaluate some of the arguments—arguably the five most common ones—that have been offered as refutations of the precautionary principle. (Or more precisely, refutations of normative claims, such as that the precautionary principle should be applied or that the precautionary principle is reasonable.) The approach to the arguments is traditional. We call the soundness of the arguments into question.¹⁹ By ‘soundness’ I here mean that an argument is (inductively) sound *iff* it is inductively forceful and its premises are true. An argument is inductively forceful *iff* it is not deductively valid, but if the premises were true, *then ceteris paribus*, it is more reasonable to accept the conclusion as true than to accept it as false. (I am

¹⁸ I am, however, solely responsible for the comments in the present section.

¹⁹ The terminology here is that of the critical thinking tradition, e.g. Bowell and Kemp (2002, Ch. 3).

not assuming that a normative conclusion like ‘we should reject the precautionary principle’ can be true. I do however assume that it can be argued for and that the argument structure can be assessed in the standard way.) In Paper IV, both the truth of the premises and their relevance to the conclusion is questioned.

The five arguments are to the effect that the precautionary principle is (1) ill-defined, (2) absolutist, (3) a value judgement, (4) increases risk-taking, and (5) marginalises science. We argue first, that the precautionary principle is, in principle, no more vague or ill-defined than other decision principles and like them it can be made precise through elaboration and practice. Second, the precautionary principle need not be absolutist in the way that has been claimed. A way to avoid this is to combine the precautionary principle with a specification of the degree of scientific evidence required to trigger precaution, and/or with some version of the *de minimis* rule. Third, the precautionary principle is indeed value-based, but only to the same extent as other decision rules. Fourth, the precautionary principle does not lead to increased risk-taking, unless the framing is too narrow, and then the same problem applies to other decision rules as well. Fifth and last, the precautionary principle is not unscientific other than in the weak sense of not being exclusively based on science. In that sense all decision rules are unscientific.

Paper V

Two of the arguments presented in Paper IV are further discussed in Paper V. These are the arguments that the precautionary principle is absolutist and that it leads to increased risk taking. In paper V, I argue that an attempt at rejection of the precautionary principle along these lines delivered by John Harris and Søren Holm (Harris and Holm, 2002) is unwarranted.

Harris and Holm’s critique begins with an attack on what they call the ‘epistemic’ version of the precautionary principle (E-PP). By ‘E-PP’, they mean a principle which requires that evidence suggesting a causal link between an activity and possible harm should be given greater weight than it would in other circumstances. They reject such principles, for the reason that they would ‘lead us to include a large number of false beliefs in our belief system’. I criticise this argument from two angles. First, I use a counterexample to show that the fact that an epistemic principle leads us to include a large number of false beliefs in our belief system is not sufficient for rejecting the principle. It must also be the case that these are false beliefs about important matters. (In fairness to Harris and Holm, it should be

said that it might well be that they have this in mind, but they do not discuss it explicitly.) Second, and more importantly, I argue that their objection presupposes a version of the precautionary principle which is not like the versions actually encountered in the discussions.

Harris and Holm proceed to criticise the precautionary principle as a rule of choice (C-PP). Their arguments are, basically, what I have termed the Argument from Absolutism and the Argument from Risk-Trade-Off. I argue that their critique is based on interpretations of the precautionary principle that ignore context, and that the versions of the precautionary principle that actually have been proposed are not susceptible to their objections. The objections, however, pinpoint areas in which clarification is needed.

Paper VI

Paper VI deals with a principle whose relation to the precautionary principle is rather complicated. The idea of *de minimis* risk says that risks that are sufficiently small, in terms of probabilities, ought to be disregarded. After a discussion of the distinction between disregarding a risk and accepting it, I discuss one suggested way of *how* small a risk ought to be in order to be disregarded. This is the natural-occurrence view of *de minimis*, which has been proposed by, among others, Alvin M. Weinberg (1985). It consists in the idea that ‘natural’ background levels of risk should be used as benchmarks and *de minimis* levels should be derived from those levels. With the aid of a hypothetical counterexample, I argue that this approach leads to counterintuitive consequences and fails, even if the doubtful distinction between what is natural and what is not natural can be upheld. I also note that the natural-occurrence view of *de minimis* might reinforce the confusion between the natural and the normal (or ordinary). Finally, I note that there is a possibility that the natural-occurrence view might be used to give an impression of the inevitability of disregarding particular risks, risks that perhaps could and should be managed.

The Authoritative Formulation?

I will conclude this Introduction by reflecting upon a remark that appeared in Paper III. I claimed that the analytical apparatus presented in the paper ‘might be used as a basis for further work with the purpose of finding *an authoritative formulation* of the Precautionary Principle’ (p. 890, emphasis added).

Since then, I have lost faith in the idea of finding an ‘authoritative’ formulation of the precautionary principle, whatever that might be. Neither do I think it necessary. This might be gleaned from the reasoning in Paper IV and Paper V. However, one of the conclusions of Paper II was that common elements could be found in various formulations of the precautionary principle. Despite the plenitude of definitions around, I believe that the core of the precautionary principle is clearly identifiable, and can be used as a starting point for further discussions. Unfortunately, not all readers seem to have appreciated this (see Graham, 1999; cf. Graham, 2000; Conko, 2003).

Nevertheless, even if we give up the search for an authoritative formulation, we should not give up searching for better ones. Perhaps the present thesis may, in a modest way, contribute to that.

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