mot1442 – Scientific Values, Text 1

Descriptive and normative claims in science and engineering

1. Declarative sentences, of which there are two types

Science and engineering rely crucially on language. Language is obviously necessary for communication among scientists. But apart from that, even for the scientist considered in isolation, language is necessary for reasoning. At the basis of science are empirical facts, and their truth can be established by direct observation. But as soon as we wish to take a step further, we can no longer rely on just observation. An important goal of science is prediction, but we cannot observe future facts; we can only arrive there through reasoning. Similarly, and related, the grasping of many empirical facts into laws or regularities requires reasoning, because we also cannot observe the generality or necessity that we take to be part of the notion of a law of science.

The building blocks of reasoning are statements, uttered through sentences. Not all the sentences that occur in language enter into reasoning, however. Questions and imperatives do not. These sentences are marked as special by the sign at their end: a question mark for questions, an exclamation mark for imperatives. The sentences that are the stuff of reasoning are 'ordinary' sentences with a dot or period at the end. Such sentences are called *declarative* sentences: they declare something to be the case, in contrast to questions, which inquire whether something is the case, or imperatives, which instruct to make something the case.

Declarative sentences, then, are candidates for expressing truth; for example

> *The magnetic needle placed next to the copper wire running from battery to switch deflected counterclockwise at 15:37.*

This uncontroversially reports something that either took place or did not take place in some laboratory on some day at 15:37. (We also consider such sentences to be false if there are no laboratory and no magnetic needle at all.) And we know very well how to assess the truth or falsity of such a sentence: by closely observing, or having closely observed, the magnetic needle placed next to the copper wire running from battery to switch around 15:37. These sentences, plus others of increasing generality or theoreticity like

> *Connecting the poles of a battery with a copper wire will cause the deflection of a magnetic needle placed next to the wire, and if the order of connection of the ends of the wire to the poles of the battery is reversed, the deflection will be of the same magnitude but occur in the opposite direction.*

and

> *Electric currents are accompanied by magnetic fields which are directed tangential to concentric circles in a plane orthogonal to the current and centred on that current.*

are what science is about. We need reasoning to establish the truth or falsity of such sentences, but even then it is hugely problematic how we can arrive at their truth, as explained in the chapter on the validation of scientific claims. Nevertheless, scientists are motivated by the firm conviction that, if any sentences have a truth value, then these sentences have.

There are also declarative sentences, however, for which it is at the very least controversial that they have a truth value. Take the following sentence:

This is a good high-frequency electronic switch.

With respect to its form it is greatly similar to a sentence like *This is a high-frequency electronic switch produced by Samsung*, and that sentence is clearly true or false: we know how to find out which of the two it is, by closely inspecting the switch, its package, and if need be the books of the supplier, the shipping company, and so forth, until we are satisfied. We are firmly convinced that there will come a moment when our investigations will satisfy us, though we may need to go to great lengths to get there. If we now look at *This is a good high-frequency electronic switch*, we realize that with this sentence it works differently. However closely the switch is investigated, it remains possible that you and a colleague of yours do not agree on whether the switch is good. Each of you arrives at a judgement concerning the quality of the switch, and this judgement will always go beyond the facts about the switch. About these facts you and your colleague will reach complete agreement, but in the judgement of what the facts about the switch mean for its quality, there is no such guarantee. What is more, you cannot argue against your colleague that she is wrong in the sense that she is speaking a falsity whereas you are speaking a truth. If you could, then couldn't she do the same thing? With respect to sentences like these, if judgements differ then the various parties fail to agree with each other concerning the judgement expressed in the sentence, but this disagreement is not a matter of some people failing to see that the sentence is true or that it is false. There is just disagreement.

Claims such as these are called *normative claims*. They are contrasted to *descriptive claims*, claims that describe the deflection of magnetic needles, and so forth. Note that descriptive claims do not necessarily describe some state of affairs. They can just as well be false, and then they do not describe anything. Descriptive claims, we could say, *potentially* describe states of affairs, or describe *possible* states of affairs or *possible* phenomena. (Which of these expressions you prefer will depend on how strict you wish to be about your metaphysical commitments concerning the existence of possibilities.).

The sort of normative claim that has been used here to introduce the class of normative statements is called an *evaluative* claim. Such claims have the form of *value* judgements. However, not all normative claims are evaluative. Take the following sentence:

You should use the Samsung switch for the set-up of the experiment.

This type of normative claim is called a *prescriptive* statement. What applies to evaluative claims applies equally to prescriptive claims: they are not candidates for being true of false. You can disagree with them or agree with them (which is a metonym for agreeing or disagreeing with the speaker). But if you disagree, it is silly to say that what the other claims is false. Whether all normative claims are either evaluative or prescriptive is an issue that will be left open.

The two types of normative claims – prescriptive and evaluative – may seem quite distinct. But we can understand the types to be intimately related in the following way. A prescriptive claim explicitly recommends an action. (Note that such a claim is *not* an imperative. It says that a certain order is 'in order', but it does not itself give that order. There definitely is a difference between *You should shut the door* and *Shut the door!*) An evaluative claim, then, implicitly recommends an action. If I pronounce a particular switch to be a good switch, I am recommending its use. If that follow-up weren't implied, then what could I be saying when I say that the switch is good beyond saying that the switch has certain properties, which can be checked and which therefore would amount to a descriptive claim? Of course, such

recommendations make sense only in a particular context of action, against a background of goals, values and ideas. In science and engineering, that context will typically be a context where the use of things is central. This could be understood in a broad sense. Take

> *This is a good explanation of the unexpected deflection of the magnetic needle that was placed next to the copper wire*.

The implicit recommendation is to use the theory or hypothesis involved for the explanation of other phenomena as well, and/or to stick with it and try to refine and elaborate it. We can call the notion of value or quality at issue here *instrumental value* or *instrumental goodness*. In non-instrumental contexts, the relation between evaluative and prescriptive claims may be much less transparent. Arguably it works for *This is a good person*. This claim can be explained as making an implicit recommendation: to be, to act like this person. It is difficult how to understand the content of the claim if this recommendation is not at least part of what we say. More problematic is the notion of aesthetic value, i.e. beauty. It is much less clear what implicit recommendation we can recognize in the claim *This is a beautiful statue*. Or rather, we can think of various recommendations, such as recommendations to watch it, to cherish it, to protect it, to come to own it, to name but a few, but this seems to lack too much precision to be really convincing. However, we trust that we will not run into such difficulties in the case of science and technology, where we at least prima facie can afford to treat all value as instrumental value. Accordingly, this is the picture of how evaluative and prescriptive claims are united into the class of normative claims that we will adhere to.

The distinction between descriptive and normative claims is crucial because the way they figure in arguments is quite distinct. We can call a descriptive argument an argument that has a descriptive statement as its conclusion, and a normative argument an argument that has a normative statement as its conclusion. In the former case, the argument serves to convince the audience that a particular descriptive claim is to be accepted, in the latter case that a particular normative claim is to be accepted. How we judge the acceptability of the conclusion in either case is subject to different criteria. Before taking up that matter, however, first more needs to be said about the character of the distinction between the normative and the descriptive.

2. How the normative/descriptive distinction relates to some other distinctions

(*i*) First of all, it is important not to equate a normative claim with an 'opinion'. Since antiquity, opinion is used as a contrast to certain knowledge. An opinion is a belief that may turn out to be false, although the person who expresses it may be convinced that it is true. But actually that much is not even assumed; an opinion can also be a wild guess and admitted to be a wild guess. Opinion relates therefore just as much to descriptive as to normative sentences. Someone could vent as her opinion that it will be a very hot summer this year. Since, as stated, normative claims are not even candidates for being true or false, opinion seems to many the 'natural' term to use for referring to normative claims. But we have a separate term for the sort of attitude that a normative sentence expresses: it is not an opinion but a *judgement*.

(*ii*) Normativity should also not be confused with *vagueness*. Take the claim

> *The level of crime has risen over the past few years*.

The truth value of this depends on the definition of crime, and how its level is to be measured. And strictly speaking it also depends on how many years 'a few' is, although this will hardly be the main bone of contention. But there is the conviction that once we settle on a definition

of crime and a measurement procedure for level of crime, the truth or falsity of the statement can be established. This would even be true for *The level of crime has risen sharply over the past few years*, since it could be included in the consensus when levels of crime rise sharply. Now as long as we have not arrived at a consensus concerning the definition and measurement of crime, the truth value of *The level of crime has risen over the past few years* cannot be established. We could either say that its truth value is indeterminate or that it is too defective a sentence to be a candidate for being true or false. What you choose will depend on your views concerning the relation between natural language and the idealized languages of logic. But neither approach will make the sentence normative. Whatever its current status, the sentence remains a candidate for being true or false, through the clarification of its terms, in a way that is impossible for normative sentences. We arrive at a normative claim if we change the sentence into

The level of crime has risen intolerably over the past few years.

Now we are not just expressing some facts about the level of crime, which we can test once we have a decent measurement procedure, but we are also saying that these facts are a reason for us to do something. And we are claiming this independently of the existence of a consensus concerning the precise definition and measurement of crime and crime levels.

(*iii*) Finally, normativity should be kept separate from *subjectivity*. Prima facie there seems to be a straightforward link between the terms 'normative' and 'subjective'. If you and your colleague differ concerning whether this high-frequency electronic switch produced by Samsung is a good switch, it is because each of you has arrived at his or her personal judgement concerning the quality of the switch. These two judgements, one stating the switch to be a good switch and the other stating the switch not to be a good switch, are intimately linked to the subjective points of view of you and your colleague. It is true that many normative claims are in this way subjective. And it is equally true that the sentences used up till now as examples of descriptive sentences are objective, in the sense that if they are true, they are true for everyone, no-one can get away from their truth. But it would be a mistake to conclude from this that subjectivity is the hallmark of normativity. The two distinctions, normative-descriptive and subjective-objective, are independent. Next to the salient combinations descriptive-objective and normative-subjective, we can also come up with examples of the less salient combinations descriptive-subjective and normative-objective.

Take as an example of the former combination the following claim:

Green to me is closer to blue than to yellow.

This claim is subjective in the sense that its truth or falsity lies entirely 'within you'. No-one else could sensibly make a claim concerning how your experience of green relates to your experiences of blue and yellow. Such experiences are, as a matter of fact, subjective. Still, what your experiences are is a matter of fact. You can lie about them. And even though other people cannot observe your experiences and in this way establish whether what you say is true, we can think of experiments that will minimally bring us closer to establishing its truth value. We can ask you questions about your colour experiences while you are connected to a lie detector or have been fed a truth drug such as Penthotal or while we are observing scans of your brain. Perhaps one day we will be able to establish the truth of this claim by observing scans of your brain while you watch patches of green, blue and yellow.

Examples of the normative-objective combination are in a sense much more abundant but also much more controversial. If we take the objectivity of a descriptive claim to lie in the fact

that if it is true it is true for everyone, then we can take an objective normative claim to be a claim that is *normatively valid* for everyone. It depends on your views concerning the character of normative judgements whether you accept that there are such claims. Some people think that certain moral judgements fall in this category, for instance:

One should not kill.

The way this claim is articulated makes clear that it aims to be understood as an objective judgement. Some people even think that all moral judgements fall in this category. Some argue that although instrumental normative claims are to some extent subjective, because they are tied to a specific set of goals, values and beliefs that a particular person has, they are also to some extent objective in that the claim is valid for everyone who has these same goals, values and beliefs. And even if one adopts this position it has to be admitted that our *access* to the truth values of normative claims, unlike our access to the truth values of descriptive claims, is a complete mystery. It takes us much beyond the purposes of this chapter to continue this discussion. It is sufficient to state that there is no decisive argument why normative claims cannot be objective, though arguing *this* must involve a further clarification of the meaning of objective and the scope of the distinction between objective and subjective.

The above examples all assume that it is straightforward whether a sentence expresses a descriptive or a normative claim. This can sometimes be a subtle matter, however, due to something which is called the distinction between *use* and *mention*. Compare the statement *Tegucigalpa is the capital of Honduras* and the statement *'Tegucigalpa' has eleven letters*. In the first sentence, the name 'Tegucigalpa' is used as a name for a certain city: it figures on a par with the other words in the sentence to do the work of describing a part of reality. In the second sentence, the word 'Tegucigalpa' is mentioned: the sentence is about the word itself and what the sentence says is completely independent of the sort of word it is and the sort of descriptive work it is used for. You do not need to know that 'Tegucigalpa' is the name of a city, or even that it has a meaning at all, to see that the sentence is true. Another more subtle example is the pair *Red is the colour of blood* (use) vs. *'Red' is a colour term* (mention). Even if I know 'red' to be a colour term, I may have no idea which things have this colour, meaning that though I can mention the term I am unable to use it. The use-mention distinction bears in the following way on the normative-descriptive distinction: I can say that X should do Y, and then what I say is clearly normative: I recommend to X that she do Y. But I can also state the same sentence without recommending anything specifically to X, but merely to report a situation which involves X. This second reading of the sentence requires that there is a context that makes it a *fact* that X should do Y, a fact that the sentence then describes, or states to be the case. And there are many contexts for which this is true. Take a debate in a parliament about whether or not the capital punishment is going to be abolished, and assume that I am a member of that parliament. During this debate I can claim *The death penalty should be abolished*, where I mean this normatively: I am urging my fellow members of parliament to vote as I do, and I list the reason that have convinced me and that I think should convince them. Then, when the voting starts, I can say another time *The death penalty should be abolished*, but now as a report of what my vote will be, or what I am voting at just that moment. I could be lying about it: I could secretly press the 'nay' button while claiming, through the statement, to be pressing the 'yeah' button. Or take another example: I could say, again in parliament, that my country should sign the treaty against the use of landmines, during a debate on what the position of my country will be. But I could also report it as a fact,

for example because my country has pledged to do it, or signed another treaty which contains as a clause that the treaty members will also sign the treaty against the use of land mines. In the latter case I am not recommending anything; I may even personally be of the opinion that my country should not sign. I am merely reporting the fact that the specific circumstances make it the case as a matter of (legal, institutional) fact that my country should sign the treaty: it is legally committed to sign it or it has promised to sign it, as the case may be.

An objection against these examples could be that they use the word 'should' in different senses. And indeed I could report the 'mention' cases in ways that cannot be used for the 'use' cases. For example, another way to state the reporting form of *The death penalty should be abolished* is *I vote for the abolishment of the death penalty*, and another way to state *My country should sign the treaty against the use of land mines* is *My country is legally bound to signing the treaty against the use of land mines*. Both rephrasings are unambiguously descriptive, either true or false. And both could without contradiction be followed by a blatantly normative counterclaim, such as *...but I think it is a bad idea to abolish it*, or *... but I think my country should ignore this situation and not sign the treaty*.

You may find these subtleties confusing enough to doubt whether normative and descriptive claims can be told apart convincingly in practice. However, we can summarize the above considerations by saying that there is a double indicator for the detection of either claim. Obviously the two indicators should and will point in the same way.

(1) A statement is *descriptive* if it is a candidate for being true or false and if we can imagine a test – some observational or experimental procedure – that will unequivocally reveal its truth value, once consensus exists concerning the precise meaning and operationalization of the terms occurring in it. A statement for which we cannot imagine such a procedure which will reveal its truth value is normative.

(2) A statement is *normative* if it contains, explicitly or implicitly, a recommendation to perform some action (however vaguely that action may be indicated by the terms used and the context). A statement that does not contain such a recommendation, that leaves it entirely open what there is for either the speaker or the listener to do, given the claim made, is descriptive.

A remaining question is whether all declarative sentences are either descriptive or normative. Let's discuss two examples. One is formed by definitions. Are they either descriptive or normative? The answer is not straightforward, since we can distinguish two sorts of definitions. Some definitions are descriptive: they report how a word is used in a particular language. If you take the meanings of words as listed in a dictionary to be definitions, these are clearly descriptive definitions. And such descriptive definitions are, obviously, descriptive statements. It is *true* that the word 'procrastination' in English means 'the putting off or delaying or deferring an action, especially out of habitual carelessness or laziness', i.e., it is actually, and also exclusively, used in that sense. Another type of definition is a *stipulative* definition. There a word is introduced into a language, with an explication of what is stands for, i.e. how it is supposed to be used. Such definitions are hardly descriptive. At the moment of introduction, they do not describe an actual use, since there is no such use yet. And indeed a case can be made for their being normative statements. Stipulative definitions can be seen as *prescriptions*: they *recommend* that a word is to be used to refer to whatever the definition specifies. Many claims that have the character of conventions, like 'the centimetre is the unit of length', are in fact such stipulative definitions. In practice, however, they may often be felt as descriptive, especially if the recommendation implied in

the original stipulative definition has been commonly accepted and/or if it has been backed up by some institutional arrangement. The situation then closely resembles the situation described in the previous paragraph, where we can switch between a normative reading and a descriptive reading reporting the acceptance of that norm in practical usage.

A second, and more problematic, example is formed by conditional sentences like 'If you want to be admitted you should wear a tie.' This is *not* the necessary condition 'You will only be admitted if you wear a tie', which is descriptive. The statement seems a mixture rather than to be plainly normative. Alternatively, it could perhaps be seen as expressing the *practical inference* that from certain premises – including, plausibly, this necessary condition that you will only be admitted if you wear a tie – a particular normative conclusion follows.

This brings us to the final issue concerning the distinction between descriptive and normative claims, that is, the way they figure in arguments and the way such arguments are assessed as acceptable, i.e. as giving sufficient support for their conclusion.

3. Descriptive and normative arguments

The basis for assessing arguments is the notion of a valid argument: an argument where the truth of the conclusion is guaranteed by the truth of the premises. In many practical cases in science and technology, if not in all (as is explained in the text on the validation of scientific claims), we come to recognize that the notion of a valid argument is a very strong one, with limited applicability. With most deductively valid arguments, we have no way of assessing the truth of the premises, and therefore no way of establishing the truth of the conclusion. And if we limit ourselves to premises of which we can assess the truth, through direct observation, we have recourse to inductive arguments only. Still, inductive arguments are typically described as arguments where the truth of the premises makes it *likely* or *plausible* that the conclusion is true. Given the crucial role that the notion of truth plays in characterizing deductively valid or inductively acceptable arguments, we understand how they can work for descriptive statements, since these statements have been characterized as candidates for being true or false and (as long as we accept only these two possibilities) as actually being either true or false. But then it is right away problematic how we have to look upon arguments figuring normative statements if these statements are characterized as *not* being candidates for being true or false in the first place. What can it main to reason validly or acceptably toward a normative statement if the truth or falsity of that statement cannot be the issue?

However, the contrast is perhaps not as sharp as suggested here. Inductive reasoning need not necessarily be characterized as reasoning where the *truth* of the conclusion is made likely or plausible. We could also say that in a satisfactory or acceptable inductive argument, the premises *support* the conclusion, or make the conclusion *plausible*. And it need not necessarily be thought that support or plausibility is support for the conclusion being true. Some philosophers who have studied inductive reasoning in science have argued that the statements figuring in inductive arguments should be looked upon as having *degrees of support* instead of truth values, and that these degrees can vary continuously between two extreme values which are the analogues of 'true' and 'false'. Likewise, we can think of normative arguments, arguments with a normative conclusion, as arguments that lend support to their conclusion. Still, this does not give us an analogue of the strong notion of a *valid* normative argument. And still, this requires us to develop a theory of how premises can support a conclusion if not in the way of guaranteeing their truth. This has turned out, during

the past half-century, to be a formidable task with respect to descriptive inductive reasoning, and it will be no less formidable for normative reasoning.

One of the most widely accepted ideas concerning descriptive and normative reasoning, although controversial nevertheless, is that the difference between descriptive and normative statements is so fundamental that there are severe limitations to how they can be mixed into a single argument. Since we can set up the notion of a deductively valid argument in terms of the truth of the premises guaranteeing the truth of the conclusion, it is not clear what work a normative statement can ever do in a descriptive argument, that is, in arguing for a descriptive conclusion. Indeed it counts as a major fallacy to make the truth of a descriptive statement depend, through an argument, on some normative claim. A well-known fallacy that does exactly this is the *ad consequentiam* fallacy. It exists in a positive and a negative variant, so to speak, which have the following two general forms:

It is good/desirable/recommendable/... that X is the case
Therefore (or weaker: this supports): X is the case

It is bad/deplorable/unacceptable/... that X is the case
Therefore (or weaker: this supports): X is not the case

The first of these is more colloquially known as *wishful thinking*, the second as *putting your head in the sand*. However obviously fallacious these arguments may seem, examples of both can be found quite regularly.

There is no simple reverse fallacy with respect to normative arguments, i.e., arguments having a normative statement as a conclusion. There is no reason why a descriptive statement could do no work in support of a normative conclusion. In fact, a widely held view on how to argue for prescriptive claims is that whether or not we should do some particular thing must, among other things, depend on what the consequences are of doing this thing. And what the consequences are of performing some action seems itself a perfectly descriptive matter. It is either true or false that performing action X in circumstances C could result in outcome R, if need be with some estimation added of how likely it is that R will result. We can imagine performing experiments to settle this. If we accept that evaluative statements are implicit recommendations for action, we can see the relevance of descriptive premises for any normative argument. What is considered a fallacy, however, of just as fundamental a nature as the *ad consequentiam* fallacy for descriptive arguments, is to propose *nothing but descriptive statements* in support of a normative conclusion. This is standardly called, in philosophy, the *naturalistic fallacy*, but we can call it the *ad naturam* fallacy, to remain in line with a custom dating back to the seventeenth and eighteenth century, where fallacies were named after what they referred to for urging the audience to accept the conclusion.[1] The *ad naturam* argument

[1] The *ad consequentiam* argument refers the audience to – 'ad' in Latin – the consequences of a conclusion being true for accepting the conclusion as true. Other examples – many of these names are quite customary in Anglosaxon liberal education – are the *ad verecundiam* argument, where a conclusion is argued with reference to the modesty that is due towards the authority of the person who puts forward the argument ('What I say is true because I know what I am talking about'); the *ad hominem* argument, where a conclusion, typically a negative one, is argued be reference to the character of a person ('What he is saying is not true because he has been caught telling lies before'); the *ad populum* argument, where a conclusion is argued by reference to the number of people who already accept it ('This is true because everyone believes it is'); the *ad baculum* argument, where a conclusion is argue by reference to the bad consequence that will befell the audience in case the conclusion is rejected ('You'd better accept this because I'll see to it that you will lose your job if you don't'). The *ad naturam* fallacy was not included in this list because the distinction between descriptive and normative statements is a relatively modern development in philosophy and was not clearly recognized in the seventeenth and eighteenth

is a fallacy because the normative character of the conclusion cannot be generated, so to speak, from exclusively descriptive statements. There is fundamental gap between descriptive statements and normative statements, a gap that cannot be crossed through reasoning. If an argument with a normative conclusion is to be acceptable, is must have at least one normative premise. Even if we look upon normative arguments as being similar to inductive arguments in that the conclusion can go beyond the premises, the (normative) conclusion cannot go so much beyond the premises that it receives support from nothing but descriptive premises, without minimally one normative premise being present to bridge the gap. And indeed the widely held view referred to above on how to argue for prescriptive claims of the sort that some action ought to be performed does exactly that. It derives such a conclusion from several descriptive premises that list the possible consequences of performing that action *and additionally* several normative premises that state how good or bad, how desirable or undesirable these consequences are.

That one cannot 'validly' derive a normative conclusion from nothing but descriptive premises is sometimes called the 'is-ought' gap, where the 'is' refers to the descriptive realm and the 'ought' refers to the normative. It has almost the status as a dogma, which can be taken to express the acceptance of a fundamental distinction between descriptive and normative statements. At the same time, its status as a dogma has repeatedly been questioned, through proposals of valid arguments that do precisely what the 'dogma' prohibits. Two oft-discussed examples were given by Max Black and John Searle. According to Black, from 'Unless I prevent you from doing so, you will do A' and 'If you do A you will die' (two descriptive statements of determinate causal connections between two events) it follows that 'I should prevent you from doing A' (a normative statement). According to Searle, from the two premises 'I have promised to paint your house' and 'To make a promise is to take upon oneself an obligation to do what was promised' (again both descriptive statements, according to Searle), the normative 'I should paint your house' follows.

centuries. Neutrally, it is an argument where we argue a conclusion by reference to 'nature' in the broadest sense, or 'the facts'. The term, therefore, is not standard. When the conclusion is normative, such an argument is a fallacy. Historically, fallacious *ad naturam* arguments made an entrance in the nineteenth century, following Darwin's theory of evolution, to argue conclusions of the sort that society should be organized on similar principles of 'natural' selection and a survival of the 'fittest', merely on the basis of the discovery that this is how nature where reference to how things were in nature, in the narrower sense of biological nature.