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31. THE DEPENDENCE OF STEPHEN TOULMIN'S EPISTEMOLOGY UPON A DESCRIPTION/PRESCRIPTION DICHOTOMY

HAROLD H. KUESTER
DEFIANCE COLLEGE

ABSTRACT. Toulmin is one of the three or four best-known philosophers of science who, beginning in the late 1950's, attempted a thoroughgoing criticism of logical positivism (the philosophy of science which predominated at that time). The paper argues that Toulmin depends upon the same sort of theory-observation dichotomy which resulted in many of the difficulties which bedeviled logical positivism. Thus Toulmin's criticism is neither as radical nor as trouble-free as many suppose.

Toulmin indicates that his epistemology attempts to overcome two contradictory options:

> a plain historical 'description' of *actual* scientific methodologies--with the inescapable threat of historical relativism--and an abstract, formal 'prescription' of *ideal* standards of scientific judgment--with the consequent risk of mere irrelevance.[1]

He contends that his epistemology constitutes a *via media* between description and prescription which retains both the need for consideration of actual scientific methodologies (description) and the need for standards (prescription). Such a *via media* would require that the proper standards for science be ascertained solely on the basis of "actual, current standards". Toulmin's discussion in the cited article seems to imply that his *via media* is made possible because of the existence of some sort of continuum between description and prescription. However, we find Toulmin's attempted *via media* to be unsuccessful because, in the final analysis it relies upon the simultaneous adoption of two conflicting epistemological positions: description and prescription.

The major portion of this paper consists of a schematic analysis of *The Philosophy of Science*, in which Toulmin explores at greatest length the issues relevant to our thesis. In order to substantiate further the thesis, we examine briefly and selectively other books by Toulmin.

I. *The Philosophy of Science*

A. Description and Prescription

Both descriptive and prescriptive epistemological aspects are identifiable in Toulmin's book, *The Philosophy of Science*. Descriptive aspects may be discerned in his contention that science begins with practical "common experience" of "everyday regularities" and "departures from them". These readily identifiable experiences "pose to the scientist his first theoretical problems".[2] Toulmin indicates what he means by prescription by referring to the following syllogism: "All men are mortal. Socrates is a man; therefore Socrates is mortal". "Men", "a man", "mortal", and "Socrates" are classifications (description). The logic (prescription), which is comprised of the relations among classifications, is found in the form of the syllogism ("All x are y").

Natural history, which Toulmin uses to exemplify description, involves the use of "everyday" classifications (ordinary natural language) which are known prior to their employment and are thus relatively immune to reclassification (change). The logic and the classifications, which together comprise the subject matter of natural history, are therefore easily separable.

Physical science, which Toulmin uses to exemplify prescription, evidences considerably more reclassification. Reclassification entails not only changes in classifications but also changes in logic (the relations among classifications). Consequently, differentiation between classification and logic in physical science involves greater ambiguity than in natural history.

> The purpose of such reclassification is to infer
>
> the characteristics of phenomena from a knowledge of their circumstances. This aim is one which ordinary language, being largely devoid of system, does not serve very well.[3]

Thus reclassification influences even observations (here, a description utilizing ordinary language) because an observation must be judged "by reference to some particular theoretical problem" (here, regarded as the logical relations among a particular set of classifications).

Toulmin sums up his distinction between the descriptive ideal of natural history and the prescriptive (explanatory) ideal of physical science by stating that "natural historians . . . look for regularities of given forms [descriptions]; but physicists seek the form of given regularities [explanations or prescriptions]".[4] Logically, the statement is obviously fallacious; the word "form" is presumably being used with two different meanings. However, even if one grants that the statement is more poetical than logical, difficulties still remain. How are "given regularities" reconcilable with or relatable to reclassification? How is the existence of "given regularities", which seem to be descriptive and to imply a relative lack of context dependence, reconcilable with or relatable to reclassification, which seems to imply a greater degree of context dependence?

B. The Construction and Use of Scientific Theories

Toulmin's subsequent discussion of the construction and use of scientific theories seems to accentuate the context-dependent character of physical science. He begins by stressing "how necessary it is always to understand" physical principles and natural laws in the "context" of their "use".[5] Utilizing physics as a kind of scientific ideal, Toulmin notes that theoretical physics is stratified. These stratifications or levels are based on the degree to which theories are considered to be "'established'". Physical principles are more basic or better established than laws which are, in turn, better established than theories or hypotheses.[6] Statements at any particular level depend upon better-established statements at lower, more basic levels of meaning. Thus if lower-level statements require alteration, upper-level statements will also require alteration.

However, relations between statements at one level and those of another are not deductive; rather, there is a "logical connection" between them:

> It is the *terms* appearing in the statements at one level, not the statements themselves, which are logically linked to the statements in the level below.[7]

Such stratification is subject to the previously discussed ambiguities associated with reclassification.

Toulmin also finds it necessary to distinguish between a theory itself and its "scope". By the theory itself, he means the "*mathematical exactitude* with which inferences are drawn in physics". By the "scope" of a theory, he means the "*practical exactness* with which the conclusions of these inferences can be applied to the systems physicists study"--i.e., to physical phenomena.[8] Presumably, the former is prescriptive and the latter descriptive. Toulmin does not indicate how the two might be reconciled or related to one another.

C. Fruitfulness of Theories

A formula (theory) may be adopted tentatively or hypothetically and tested to determine its fruitfulness--i.e., whether or not it accurately represents the phenomena in question:

> very soon--indeed, as soon as its fruitfulness has been established--the formula in our hypothesis comes to be treated as a *law*, i.e., as something of which we ask not "Is it true"? but "When does it hold"?[9]

Laws of nature "are not themselves true or false, though statements about their range of application can be". Implied in Toulmin's question, "When does it hold?", is the confidence that one can recognize the circumstances under which a theory either does or does not hold. By implication, these circumstances must be either partially or wholly theory-independent if they can be used to determine the scope of theories. It may be that what Toulmin has in mind is the "common experience" with which he believes that science begins.

It is our hypothesis that Toulmin's confidence in a person's ability to recognize a fruitful theory--i.e., its descriptive character--allows him to ignore what would otherwise be logically prior questions, such as "What is fruitfulness"? We shall trace applications of this concept in order to indicate, among other things, that he does not confront such questions.

Toulmin distinguishes between "'phenomenological laws'" and laws which contain theoretical terms. The former--e.g., Boyle's law (the pressure and volume of a gas vary inversely at a given temperature)--"involve no theoretical terms at all"[10] and thus seem to be closely related to phenomena. Laws which contain theoretical terms--e.g., Newton's Three Laws of Motion--are "not used directly to express the form of a regularity found in phenomena" and thus seem to be less closely related to phenomena. Taken in isolation, Toulmin's distinction between the two kinds of laws is clear. However, his discussion of the stratification of theoretical physics which precedes this description of phenomenological laws prepares the reader only for a distinction of degree, not of kind.

This apparent discrepancy or logical gap suggests the following question: Is it really true that Boyle's law involves no theoretical terms at all? This is what Newton seem to imply when in subsequent editions of his *Principia* he refers to Kepler's Laws as though they were merely phenomenal. Toulmin apparently agrees, for he regards Kepler's Laws as "even more completely phenomenological than Boyle's Law".[11] Since Toulmin's epistemology will not permit him to make Newton's claim of "hypotheses non fingo" (the disavowal of recourse to hypotheses), the exact status of his phenomenological laws seems problematical. His subsequent discussion of what laws possess in common does not clarify or justify the distinction between phenomenological laws and laws which contain theoretical terms. By seeming to claim that laws are not directly relatable to phenomena, it is unclear what he means by phenomenological laws, which he claims *are* directly relatable to phenomena. It does seem clear that Toulmin considers phenomenological laws to be more descriptive than those more prescriptive laws containing theoretical terms. But the exact status of phenomenological laws is problematical.

Toulmin's distinction between the two kinds of laws seems to be an attempt to avoid adoption of the position which he rejects at the conclusion of the chapter: that "the link between laws of nature" (formal structures, theories, etc.) and "the world" (empirical applications, observations, etc.) is broken when the assumption is made,

> . . . that the only statements representing genuine 'propositions' are those which are straightforwardly classifiable either as necessary (formal structure) [i.e., prescriptive] or as contingent (empirical application) [i.e., descriptive].[12]

In order to avoid such isolation of the two kinds of propositions from one another, Toulmin proposes a *via media* consisting of a combination of M. Schlick's notion "of the investigator finding his way about in reality" and G. Ryle's notion of "law-like statements as inference tickets".[13] Toulmin's example is that of a scientist who prints his own travel tickets and sees how far he can travel with them. By this means, Toulmin seeks both to retain the distinction between the scope of a theory (its empirical applications) and the theory itself (its formal structure) and to af-

firm the link between the two in terms of a theory's fruitfulness (to see how far one can travel with a theory).

Thus we return to Toulmin's conception of fruitfulness. In *The Philosophy of Science* no means other than fruitfulness is given for determining under what conditions a theory may be said to hold. In the absence of such means and because no further explication is given of the conception of fruitfulness, we conclude that Toulmin does not define it because he assumes it to be readily identifiable or unambiguous--i.e., essentially descriptive in character.

The descriptive character of fruitfulness is evident in Toulmin's argument supporting his claim that scientists do not need to make assumptions such as The Principle of the Uniformity of Nature. Two aspects of his discussion are relevant: (1) the examples are drawn mainly from astronomy; and (2) the discussion seems to indicate that mistakes can be detected with ease.

We interpret the first aspect to accord with Toulmin's contention that "physicists seek the form of given regularities". Here, the given regularities refer to the seemingly effortless scientific identification of astronomical entities--e.g., planets--and their motions:

> When one checks the motions of the planets against the astronomer's dynamical calculations, it almost seems as if Newton's Laws are plain statements of fact about the planets themselves: for a moment the logical gulf between Kepler's Laws and Newton's seems to vanish.[14]

If our interpretation is accurate, Toulmin's present claim is incompatible with his earlier claim that physical science progresses, as a rule, by reclassification. Reclassification entails at least a partial change in the identification of entities and thus of their logic (relations among them). Yet reclassification of astronomical entities and their motions was not a factor in the advance of astronomy as portrayed here by Toulmin. Regarding aspect two, reclassification could render the detection of mistakes a difficult and ambiguous undertaking since mistakes and their detection might not be classification invariant. Thus what might count as a mistake under one classification might not count as a mistake under another.

Toulmin's discussion does not involve overt contradiction because he limits himself to specific examples. However, if taken literally, his statements seem to require the existence of some sort of readily identifiable or unambiguous--i.e., descriptive--evidence for the identification of both classifications and mistakes. Such identification would appear to be a prerequisite for the determination of fruitfulness, for without the identification of classifications or mistakes no judgment can be made as to how far one can travel with a theory. Perhaps our interpretation is an overstatement, since Toulmin does contend that "terms" (though not "statements") can remain constant through several strata of theories. However, these terms are subject to possible reclassification, whereas Toulmin's examples seem to suggest that the "common experience" characteristic of many descriptive aspects is not likely to require significant reclassification.

II. OTHER BOOKS

The description/prescription dichotomy is also found in others of Toulmin's books. We shall schematically trace his treatment of this dichotomy in three books which have considerable subject matter in common with *The Philosophy of Science*, noting where emphases differ.

The Uses of Argument

Toulmin's distinction between logic as a "formal science" and the application of logic ("practical questions")[15] is similar to his distinction between a theory and its scope or application. Logic, like a theory, is more prescriptive; the application of logic, like the application of a theory, is more descriptive. The general conclusion which Toulmin draws is that no purely formal means exists for the application of logic; this is similar to his conclusion that a theory and its scope are not deductively related.

Although applied logic involves "practical questions", Toulmin distinguishes between applied logic and ordinary experience or knowledge. He characterizes epistemology as "a branch of comparative applied logic".[16] In so doing, he attempts to retain both "psychological" knowledge ("*a posteriori*") and formal knowledge (including applied logic). The precise character of the distinction between "psychological" knowledge and applied logic is difficult to discern because Toulmin appears to associate "statements about seemings" with formal logic and "statements about the actual state of things in the world" with applied logic; this latter could also be the domain of ordinary experience or knowledge.[17] This lack of precision parallels our difficulty in clearly understanding the status of the descriptive aspects of science as presented by Toulmin.

Foresight and Understanding

In *Foresight and Understanding*, Toulmin stresses the importance of practical common experience. Instead of merely claiming that science begins with such experience, as in *The Philosophy of Science*, he now explicitly rejects the notion that scientific knowledge is different in kind from ordinary knowledge. Science and pre-science (ordinary knowledge) may be distinguished on the basis of the theories or 'ideals of natural order' possessed only by the former. However, these ideals of natural order are not different in kind from the patterns found in everyday life and thus in pre-science; science begins by refining such patterns. As in *The Philosophy of Science*, these ideals of natural order, while not directly deducible from ordinary experience or knowledge, may be tested ("prove their worth over a longer term") in a manner suggestive of Toulmin's conception of fruitfulness.[18]

Foresight and Understanding also lays greater stress upon the context-dependent--i.e., prescriptive--character of science than does *The Philosophy of Science*. Within science, ideals of natural order both determine what it is to be accepted as intelligible and establish among different sciences an order of subordination--i.e., a setting of rational standards. Rational standards are context-dependent because the ideals of natural order on which they depend are themselves formulated relative to particular contexts. True, Toulmin admits, two reasons can be given for changes of idiom: (1) "direct empirical justification" and (2)

"changing theoretical affiliations". But these are also ultimately context-dependent--i.e., matters of "style" or "mere fashion".[19]

However, this greater emphasis upon context dependence or prescription is offset by descriptive factors, such as what Toulmin calls fruitfulness in *The Philosophy of Science*. As previously indicated, the ability to detect fruitfulness implies the ability to detect mistakes (here labelled "the anomalous"):

> In ordinary life explanation may, perhaps, consist in 'relating the unfamiliar to the familiar'. But, as science develops, this turns into 'relating the anomalous to the accepted', and so in due course inevitable. Which things are familiar and which unfamiliar is a relative matter. . . . On the other hand, whether an event is 'anomalous' or not need not be so personal a question. It can be discussed rationally--still more, if we go to the length of labelling the event as a 'phenomena' and implying that it needs to be squared with theory. For then our standard must be, not what is familiar, but rather what is intelligible and reasonable in the course of Nature.[20]

We interpret Toulmin's position to be tantamount to supposing that, while theories cannot be derived directly from sense experience, it is possible to determine whether a theory is helpful or misleading. If true, this would seem to indicate the existence of a readily identifiable or unambiguous (i.e., descriptive) structure of everyday experience to which a theory must conform but from which a theory cannot be directly derived--in effect, a descriptive/prescriptive dichotomy.

Human Understanding, Vol. I

As Toulmin admits in the Preface to *Human Understanding*, his argument rests upon the central thesis of *The Uses of Argument*: the practical (descriptive) approach is capable of resolving otherwise insoluble questions. More can be learned about what constitutes "rationality" from the "demands of the problem situation" (practical approach) than from "formal considerations". Questions concerning the nature of rationality must be asked prior to the construction of formal systems. The practical approach, in Toulmin's view, correctly focuses attention upon "historically developing problems and strategies", permitting one to distinguish between the solutions actually chosen in a historical context by a researcher and those which the "genuine needs" of the problem situation would have "demanded" if "accurately judged".

Toulmin elaborates on this position in the "positive part" of his epistemology, which he terms "ecological". This ecological approach to epistemology is based upon the contention that the structure and correspondence of conceptions (theories) is figurative: "the more strictly 'theoretical' a statement is, the more its empirical relevance is a matter of applicability [i.e., scope], rather than of truth".[21] This is similar to his position that, although theories are not deductively related to ordinary experience, they may be evaluated on the basis of their fruitfulness or scope of applicability.

In keeping with his contention that what constitutes rationality will depend to a considerable extent upon the demands of particular

problem situations, Toulmin holds that different historical periods may rely upon quite different conceptions of rationality. Disciplines may change "even in their deepest rational strategies";

> As we now understand it, nothing in the empirical world possesses the permanent unchanging identity which all Greek natural philosophers (the Epicureans apart) presupposed in the ultimate aspects of nature. . . . Confronted with the question, 'How do *permanent* entities preserve their identity through all their *apparent* changes?', we must simply deny the validity of the question itself. In its place, we must substitute the question, 'How do historical entities maintain their coherence and continuity, despite all the *real* changes they undergo?'[22]

The quotation seems to imply that changes in conceptions of rationality are never entire or complete. As Toulmin acknowledges elsewhere, changes in scientific conceptions are "piecemeal" and, although over the last hundred years these changes have been "striking", they have nevertheless been "progressive and cumulative".

Both descriptive and prescriptive aspects may be found here. It is difficult to avoid concluding that the terms "coherence and continuity" and "progressive cumulative" impute to the knowing process and its products some sort of permanence, however qualified or tentative--especially when coupled with the contention that changes are not complete but piecemeal. As indicated previously, permanence is an attribute of descriptive aspects of Toulmin's epistemology. The radical change, of which he also speaks, is an attribute of prescriptive aspects of his epistemology.

Toulmin considers the most serious challenge to his epistemology to be the denial that he has established an "impartial" standpoint for rational judgment. According to Toulmin, the challenge implies that one must judge rationality in terms of either "arbitrary, external 'demarcation-criteria'" or a "thoroughgoing", and therefore relativistic, empiricism. Both at the present point in the text and throughout *Human Understanding*, he argues that these criteria for the judgment of irrationality should be rejected in favor of a practical or informal approach to the judgment of what is rational. In our estimation, such an approach would have to rely to some degree upon that which is readily apparent or lacking in ambiguity (i.e., is descriptive).

III. Conclusion

We have discovered similar descriptive and prescriptive aspects of Toulmin's epistemology in each of the books considered. Each book contains its nuances, but their basic themes remain essentially the same. Toulmin directs much attention to the various descriptive and prescriptive aspects of epistemology, but relatively little attention to the relationships between these aspects. Such lack of attention results in a *de facto* description/prescription dichotomy. The ready identifiability or lack of ambiguity of descriptive aspects means that they tend to function as a kind of neutral observation language. The potential for radical change associated with the prescriptive aspects means that they tend to

convey a sense of rather thoroughgoing theory dependence or context dependence.

When viewed together, these two aspects seem to constitute a genuine *via media*. Toulmin's attempts to construct one distinguish his epistemology from those of the early Thomas Kuhn and Paul K. Feyerabend, whose epistemologies, while also tending to rely upon an implied neutral observation language, convey a greater sense of theory dependence--i.e., relativism. However, Toulmin would need to strengthen and elaborate upon the interdependence and interrelations of the descriptive and prescriptive aspects of his epistemology in order to make a more convincing case for his *via media*.

ENDNOTES

[1] Stephen Toulmin, "Reply, On Prescribing Descriptions", *Synthese*, 18 (1968), 462.

[2] Stephen Toulmin, *The Philosophy of Science* (New York: Harper and Row, 1960), 45.

[3] *Ibid.*, 52.

[4] *Ibid.*, 53.

[5] *Ibid.*, 57.

[6] *Ibid.*, 80ff.

[7] *Ibid.*, 85.

[8] *Ibid.*, 70f. Toulmin actually speaks about laws, not theories; however, nothing in his discussion suggests that the difference between the two is other than a matter of degree. Therefore, we have substituted the word theory.

[9] *Ibid.*, 79.

[10] *Ibid.*, 86.

[11] *Ibid.*, 87.

[12] *Ibid.*, 103.

[13] *Ibid.*, 103f.

[14] *Ibid.*, 160f.

[15] Stephen Toulmin, *The Uses of Argument* (Cambridge: Cambridge University Press, 1958), 3.

[16] *Ibid.*, 211f.

[17] *Ibid.*, 223.

[18] Stephen Toulmin, *Foresight and Understanding* (New York: Harper and Row, 1961), 100.

[19] *Ibid.*, 97.

[20] *Ibid.*, 61.

[21] Stephen Toulmin, *Human Understanding* (Princeton: Princeton University Press, 1972), Vol. I, 170.

[22] *Ibid.*, 232, 356.