Constructivism Deconstructed

W. A. SUCHTING

231 Bulwara Rd, Ultimo, NSW 2007, Australia

> ... *ridentem dicere verum*
> *Quid vetat?*
> Horace, *Sat.*, I.i.24

ABSTRACT: This paper examines the doctrine of 'constructivism' as presented by Ernst von Glasersfeld (1989). Part I attempts to elicit a clearer statement of the concepts, positions and arguments for the latter than is immediately available in the paper. Part II discusses the problem of intersubjectivity in constructivism. The general conclusions drawn from these sections is that the basic concepts and theses of constructivism are, mostly, at best very obscure, that there is very little argument involved, and that where there is it is quite unsatisfactory. Part III ventures an explanation of at least some of the weaknesses in the doctrine, this involving a brief independent treatment of some relevant epistemological questions.

1. This paper is concerned with a doctrine which has for some time been very influential in thinking about education, namely 'constructivism', associated especially with the name of its originator and principal exponent, Ernst von Glasersfeld.[1] More specifically, it will examine the doctrine as presented in that author's 'Cognition, Construction of Knowledge, and Teaching' (1989). This has been chosen as a textual basis for the discussion not only because it is by von Glasersfeld himself, but also because it is sufficiently recent for the reasonable assumption to be made that it contains his latest public thoughts on the theory; furthermore, it is brief enough to be considered comprehensively but compendiously. All otherwise unattributed quotations and page references in the main body of this paper will be from and to this publication.

I

> And all were amazed and perplexed,
> saying to one another, 'What does this mean?'
> *Acts* 2:12

2. The first task is to identify and to state as clearly as possible for present purposes the principal concepts, positions, and supporting arguments distinctive of constructivism. This doctrine itself holds that 'language users must individually *construct* the meaning of words, phrases, sentences and

texts' (132), so we must expect, if this is so, to have to do the same for that theory itself.

If we focus first on basic positions, which of course presuppose basic concepts, then we may remind ourselves that there are in general two ways of trying to specify the fundamental theses of a doctrine. One is direct, an attempt to state them just as such. The other is indirect, following the lead of Spinoza's dictum *determinatio negatio est* (Letter 50), to see what is being affirmed by trying to see what is being denied, excluded; this is often illuminating, especially when the theses offer some obstacles to being identified. This approach, to the extent that it is successful, will yield at least a delimited range of possibilities as to what is actually being asserted. Adapting a theological distinction and terminology, the first method may be called the *via affirmativa* and the second the *via negativa*.[2] Our beginning here with the latter is suggested by the fact that the paper being discussed commences with a reference to what constructivism opposes, the 'theory of knowing' to which it is an 'alternative' (121). So this is where, in fact, a start will be made.

3. The paper opens by saying that what constructivism denies is 'the existence of objective knowledge and the possibility of communicating it by means of language' (121).

3.1. Firstly, what is the point of the last four words? Taken by themselves they would naturally be understood to state or imply a qualification of some sort. But there is no hint as what this might be intended to be, and it seems impossible to see how 'objective knowledge', were it to exist, could be communicated *except* by means of a language of some sort. So there is nothing for it but to consider them otiose and in effect to elide them.

Secondly, consider the five words immediately preceding those just commented upon. They are also very puzzling in the context of the cited passage in which they appear. For if 'it', that is, 'objective knowledge', is asserted not to exist, and does not exist, there can be no question of the possibility of communicating 'it' (linguistically or in any other way), as distinct from the possibility of merely *seeming* to communicate 'it'. (It is rather like saying that God does not exist and we cannot communicate with Him either.) Could it be that the non-existence of 'objective knowledge' is asserted only as a contingent matter, and that what is meant is that if such knowledge were to exist, contingently, then it could not be communicated (contingently or necessarily, as the case may be)? But since it is said elsewhere (e.g. 135) that 'objective knowledge' is *impossible*, there can be no question about what might be the case were it to exist. So it would seem as though this part of the text can be excised, too.

3.2. What is left is the denial of 'the existence of objective knowledge'. Now, since constructivism certainly wants to affirm the existence of knowledge in *some* sense the key word here must be 'objective'. What is meant by this in the present context? The paper says at one point, in passing (138, note 1), that the word is commonly used in two ways: '(a) referring

to knowledge that purports to describe the world as it is; and (b) knowledge that purports to be intersubjective.' Now this cannot be quite right, for what is meant by qualifying knowledge as 'objective' must surely be not that it merely 'purports' to describe the world as it is or to be intersubjective, but that it *does* describe the world as it is, or *is* intersubjective, though of course that claim may be incorrect, in which case the knowledge would indeed only 'purport' to be thus descriptive or intersubjective. So what must be meant is that 'objective' is commonly used to claim (a) their knowledge describes the world as it is and/or (b) their knowledge is intersubjective. Now, since constructivism itself wants to claim (with what right there will be later occasion to inquire) that knowledge is intersubjective, sense (b) of 'objective' can be ignored here, and attention can be directed exclusively to (a). So, by simply replacing *definiendum* by *definiens* in the expression cited at the beginning of this paragraph, what is denied by constructivism becomes: 'the existence of knowledge that describes the world as it is'.

3.3. There are at least two problematic items here, namely, 'describes' and 'as it is'.

3.31. What is the import here of 'describes'? From the evidence of various passages (e.g. 122, 135) it would seem to be used more or less synonymously with 'represents', for 'representation' is the word used to refer to what is being rejected at those places. (The reprobation of 'representation' is sometimes marked by enclosing the word in scare quotes.) But what is it about what is signified by these terms that is being rejected? This is never stated. But the chief textual clue to 'constructing' what it is may well be the close association of both with 'corresponds'. This is presumably meant in the manner in which the cognate occurs in the 'correspondence theory of truth'. This may be said to affirm that the truth of propositions is determined by some one–one correspondence between the terms of the proposition and the elements of some fact, where 'correspondence' means (briefly, and therefore roughly) that there is some common relation between each member of the one class and some member of the other, the relation being customarily left fairly vague though something like a 'picturing' relation (cf. Wittgenstein's *Tractatus*) seems most often to be meant. So the formulation at the end of 3.2 may now be restated as: 'the existence of knowledge that corresponds to the world as it is', understanding 'corresponds' in the way just explained.

3.32. What, now, is the import of '[the world] as it is'? At another place this seems to be used synonymously with 'what exists' (135). The problem with expressions such as these in the context of what is being denied is that, taken by themselves, they are vacuous. For anything at all that purports to be knowledge must, in some sense or other, be about the world 'as it is', or 'what exists'. The point here is: what, more exactly, *is* it that 'is' or 'exists'? (The case is similar with a claim like: 'The future will be what it will be', which has sometimes been thought to express some particular docrine, usually fatalism, when it is really just a dry

pleonasm from which no philosophical milk can be squeezed.) The connection of these locutions with 'real' (125) is by itself not of much help. (The cognate 'reality' is sometimes scare-quoted – for example, 121 – sometimes not.) The scent gets stronger with phrases like 'ontological reality', 'absolute reality' (129,135). In particular, since 'absolute' means, among other things, 'free of all dependence', 'totally independent', we may take it that what all these locutions point to is what is termed at once place (122) 'an observer-independent world-in-itself'. So, putting together all the various parts of the puzzle such as have been assembled so far, we have that what constructivism denies is 'the existence of knowledge that corresponds to an observer-independent world-in-itself'.

3.4. Before beginning the next stage of the exegetical journey, this time on the highway of the *via affirmativa*, it may be useful to issue a caution about a false trail. Here and there along the *via negativa* there occurs what may be taken to be a signpost: a rejection of 'the quest for immutable objective truth' (122). The association here of 'immutable' with 'objective' as qualifying 'truth' might well suggest to the hasty and incautious that the latter is a sufficient condition for the former, or even a necessary condition. This may be reinforced by talk of denial of 'certain knowledge about the world – objective knowledge' (135). But in fact 'immutability' or 'certainty' has nothing essential to do with the question of 'objectivity', in the sense in question, when all are used in the context of questions about knowledge. For example, the so-called 'Galilean' transformation equations of classical kinematics proved not to be 'immutable', insofar as they are replaced in special relativity by different, more general equations. But the former were not simply rejected, but shown to be only conditionally applicable, the limits of applicability being exactly specifiable. So the approximations the Galilean equations permit the physicist to calculate are not less 'objective' than the previous, putatively non-approximative ones. As regards 'certainty' it is perfectly proper to say (within this whole epistemological framework) that the statement: 'Isaac Newton, the famous physicist, was born on 4 January 1643' is true and an instance of 'objective' knowledge, and *also* that it is not an instance of certain, that is, incorrigible knowledge (if such there be). This is so if only because statements of that *sort* are sometimes false (even if believed to be true), and, even if this were not the case, such statements are such that it is easy to see how the evidence for their truth might be less than absolutely probative. So let this linking of 'immutability' and 'certainty' with the idea of 'objectivity' regarding knowledge be set aside once and for all.

4. To approach the problem of presentation of constructivism more positively now, it may be said to begin with that if it denies the thesis formulated at the end of 3.32 above, then, assuming that it affirms the existence of knowledge of an alternative sort, the latter must be knowledge of a world that is *not* observer-independent, that is, it must be knowledge of an observer-dependent world. This position, so far inferred from what is said to be denied, is in fact also to be gathered from various things that

are said on the second page (122) of the paper under examination. Thus it is said here that 'the conceptual constructs we call knowledge' have their place in 'the experiential world of the knowing subject', in 'subjective realities', 'biological organisms' self-generated environments', the individual's subjective reality', which is a *'construction'*. A number of different, even if related things are said here and it will be well to try to get them into focus. The following is offered as at least a first list of main theses.

1. Knowledge consists of 'conceptual constructs'.
2. Knowledge relates to (subjective) experience.
3. This experience is that of *individual* subjects.
4. This individual experience is 'reality' for the subject of the experience.
5. This reality is a 'construction', 'self-generated'.

Now, with regard to (1), whilst being a 'conceptual construct' may well be a necessary condition for some item's being an instance of knowledge, it cannot also be a sufficient condition, for some 'conceptual constructs' are not instances of knowledge. In fact, the paper tells us that for such to be instances of knowledge they must be 'viable' in or for experience (122, 124,125, etc.), and later on (135) that knowledge has to be what is 'feasible' in experience, 'viable' and 'feasible' being thus apparently synonymous. Furthermore, it is said (135) that knowledge *qua* 'feasible' is a 'mapping'. So 'viable'/'feasible' would seem to be what replaces, for constructivism, objectivism's 'paradoxical conception of truth that requires a forever unattainable ontological test' (129), and 'mapping' is what replaces 'description'/'representation'/'correspondence'. So (1) above should be reformulated, and this may be done as follows.

   (1′a) Knowledge
           (1′a) consists of 'conceptual constructs', that
           (1′b) are 'viable'/'feasible' in individual experience, and as such
           (1′c) are 'mappings' of that experience.

So, slightly to reformulate the whole matter again, it may be said that according to the presentation so far, constructivism affirms the following:

  (A) As regards 'reality', the latter is, at least insofar as it is knowable,
     (1) the experience of an individual subject, and
     (2) a 'construction' of that subject.
  (B) As regards knowledge, it
     (1) consists of concepts,
     (2) is a 'construction' or 'result of a construction',
     (3) the construct being a 'mapping' of what is 'viable'/'feasible' in the experience referred to under (A) above.

These theses must now be looked at somewhat more closely.

   5. (B) may be taken first, as the issues here are, if not all straightforward, at least more so than those under (A).

   5.1. (B1) need not detain, as in some sense of 'concept' it is clearly

true. But (B2) needs attention. To start with, what is meant by 'construction'? Since this idea also arises in the context of (A), to be considered further on, the general question may as well be broached here. No technical meaning has been assigned to the word in the paper being examined. Therefore there is nothing for it but to concentrate on the standard ordinary meaning. According to the O.E.D., the primary meaning of the verb 'construct' is: 'To make or form by fitting the parts together; to frame, build, erect'; 'construction' as a verbal noun is the action of so doing, and, as denoting the product rather than the process, it means 'a thing constructed'. Spelling this out (with an eye to the Aristotelian 'four causes') it may be said that 'construction' involves: (1) some preexisting material ('the parts'); (2) some principle (as it were) of construction (governing the 'fitting together' of the parts); (3) some executor (of the making, forming, fitting together); (4) some end-in-view (since normally constructing is done for some purpose, as a house for shelter, ostentation, or whatever).

In the next place, what, more precisely, about knowledge is supposed to be a 'construction'? Two possibilities immediately present themselves, namely, the constituent concepts and the statemental/propositional complexes from concepts which may be affirmed or denied to the 'viable', and so on (of course, the conjunction of these two possibilities is a third possibility). Now of the first possibility it may be said that we can distinguish, even among our quotidian concepts, (a) some that we just normally come by, so to speak, 'spontaneously' formed concepts like 'red', 'loud', 'rough', even 'ugly', 'decent' and so on, and (b) others that are more or less artifically formed, like 'bachelor', 'motor car', 'immigration'; and of course the second sort increase in significance the further we move towards the heart of scientific concept-formation proper. Though the first may be said to be 'constructions' from the point of view of later scientific analysis (logic, psychology, linguistics, and so on), it is the second sort that may be more commonsensically called 'constructions' in the light of the ordinary dictionary definition, the application of which here is fairly straightforward, at least for present purposes. Coming now to the second possibility as to what may be properly called a 'construction' in the context of knowledge, namely, the statemental/propositional one, it is clear enough that it is in order to make a distinction here similar to that just made in the case of concepts. More specifically, we just 'pick up' certain ways of putting words together (e.g. 'The dog barked') while we have to learn other ways (e.g. more or less complex concatenations of clauses, rephrasings in the terms of a canonical logical notation). Again we can properly call the second 'constructions' in a quite straightforward, commonsense way, in accordance with the dictionary definition. So each possibility is open for understanding how knowledge is a construction (and hence both). So far, so good.

5.2. What about (B3)? There are at least two major questions of interpretation here. One is how 'mapping' differs from 'corresponding'. The

other is how 'viable'/'feasible' differs from 'true', or, speaking more ex-
actly, since the former seem to be clearly evidential/epistemic concepts
whilst the latter is, in the way it is used in Glaserfeld's paper, anyway, an
'ontological' one, and are hence not categorially commensurable, how
does 'viable'/'feasible' differ from what are frequently, indeed probably
usually, taken as evidential/epistemic correlates of truth, like 'verified',
'confirmed', and the like?

5.21. As regards the first question, the paper being examined supplies
no material whatever on which to base an answer. 'Mapping' is not ex-
plicitly introduced as a technical term, and its ordinary meaning involves
'correspondence', at least in the sense of a rule-governed 'projection'-
relation between what maps and what is mapped. If it is suggested that a
map need not 'resemble' what is mapped, in the way in which even the
worst photograph of something resembles it (otherwise it would not be
called a photograph) it may be rejoined that it is at least very doubtful if
even the most conservative proponent of a traditional 'correspondence
theory of truth' thinks that, say, 'In a closed system, entropy tends to
increase with time' *resembles* something in the preceding sense. (What
such a person would say more nearly about the alleged 'correspondence'
relation would also be certain to be obscure or seemingly vacuous, but
that is not the point here.) So it seems as though we must take the key
term 'mapping' as a primitive, and people are free to attach whatever
subjective meanings to it they wish.

5.22. As regards the meaning of 'viable' (and hence 'feasible', since
this is linked with 'viable'), though this is not explicitly introduced either,
and its ordinary meaning is too loose to function satisfactorily, just as it
is, in an epistemology, there is the clue offered by the remark that it is
synonymous with Piaget's 'adapted' (125), keeping in mind that it is also
said that the constructivist 'orientation was . . . propounded . . . by Piaget
as a developmentally grounded constructivist epistemology' (121). More
specifically, Piaget's significance for constructivism is summarised as fol-
lows:

> . . . knowledge for Piaget . . . is the collection of conceptual structures that turn out to be
> adapted . . .within the knowing subject's range of experience. . . . cognitive change and
> *learning* take place when a scheme, instead of producing the expected result, leads to
> perturbation [= 'disappointment' 127 – WAS], and perturbation, in turn, leads to accom-
> modation that establishes a new equilibrium. Learning and the knowledge it creates, thus,
> are explicitly instrumental . . . His theory of cognition involves a two-fold instrumentalism.
> On the *sensory-motor* level, action schemes are instrumental in helping organisms achieve
> goals in their interaction with their experiential world. On the level of *reflective abstraction*,
> however, operative schemes are instrumental in helping organisms achieve a coherent
> conceptual framework that reflects the paths of acting as well as thinking which, at the
> organism's present point of experience, have turned out to be viable. The first instrumen-
> tality might be called 'utilitarian' . . . The second, however, is strictly 'epistemic'. (125,
> 128, 129)

It is impossible to avoid a feeling of profound anticlimax on concluding
this passage, for far from registering the radical 'shift of epistemological

presuppositions' (121) promised, in essence it sets out simply some central features of a fairly standard, middle-of-the-road, more or less recent empiricist position. That this is the case is concealed, to the extent that it is (surely only to the neophyte in such matters), by the use of relatively unfamiliar terminology, and any effect produced by this can be cancelled just by a translation back into the original, using a dictionary containing such entries as: 'adapted' = 'confirmed', 'scheme' = 'theory', 'perturbation' = 'disconfirmation'/'falsification', 'accommodation' = 'theory-change/modification', and so on and so on. The page on which it is written shows itself to be a sort of palimpsest where an empiricist text has been written over by a 'constructivist' translation, and an empiricist would be justified in doing just a little rewriting himself and exclaiming, after Horace:

> Mutato nomine de me
> Fabula narratur.

So once more the examination has drawn a blank in the search for a more than sloganistic presentation of 'constructionism'. Perhaps it will do better with the theses assembled under (A) at the end of Section 4 above. Anyway, to these it now turns.

6. The theses in question pose at least two basic questions, namely, what does it mean to say, and why should we say (1) that to talk of 'reality', at least of that 'reality' which is accessible to knowledge[3], is to talk of the experiences of individual subjects, and (2) that this 'reality' (experience of the individual subject) is a 'construction' (of that subject)?

6.1. To begin with (1), it must be said to start with that constructivism is again only following a completely traditional form of empiricism in speaking of the object of knowledge as being 'experience' (or something that adds up to the same thing). Now familiarity with this habit should not breed contempt for at least the following facts. First, this 'experience' is never normally introduced as a technical term. Second, it is therefore left to be understood in at best some ordinary, everyday sense or other. Third, what is normally taken to be known is never 'experience'. If we look at the history of the word in English we find that the verb is derived from the noun, which itself originates (proximately anyway) in the Latin verb *experior*, meaning to try or test, and that the English noun preserves this sense virtually exclusively till about the last third of the eighteenth century. (Dr Johnson's *Dictionary* of 1755, for example, lists no other meanings than 'practice; frequent trial; knowledge gained by trial and practice'.) There is nothing especially pertaining to 'consciousness' here. After the time mentioned this meaning persists, but is joined by another which involves reference to a particular kind of consciousness which can in some contexts be distinguished from or even contrasted with reasoning, conscious experiment, knowledge, including as it does feeling as well as thought (as in 'aesthetic experience', 'religious experience').[4] But this is rather the exceptional case and in general it is even here a matter of the

experience *of* something (e.g. religious experience has to do with God). So in general the ordinary noun 'experience' has an objective 'intention' (experience *of* something) and the verb is basically transitive (someone experiences *something*). The experience is a *means to* knowledge not the *object of* knowledge. Even where we might be inclined to say that our experience is something more or less purely subjective, as in the case of an hallucination, which someone might begin describing by saying: 'I had a strange experience', the noun is being used in a 'logically secondary' way, that is, roughly, in a manner the understanding of which depends on understanding the primary objective sense: it is of the essence of an hallucination that it is *like* 'the real thing'.

Much more could be said on this head, but I hope the thrust of the discussion is clear, namely, that insofar as someone is using 'experience' in its ordinary meaning there is nothing normally 'subjective' about it, and so some special arguments must be provided to justify a contrary view of the matter. Historically, arguments of this sort were offered by, for example, Bishop Berkeley. But the paper under examination does not offer any such arguments and does not even hint at what they might be. In view of the existing body of powerful argument against taking the object of knowledge to be 'experience', even against the intelligibility of this,[5] it is utterly inadmissible in a serious philosophical discussion not to offer grounds for rejecting these arguments if the acceptability of the position depends upon their disposal.

6.2. To pass to the second question posed at the beginning of this section, that of 'reality' = 'experience' being a 'construction', strictly speaking, if the first question is unresolved, as 6.1 has suggested it is, then *caedit quaestio*. But a few remarks may be offered anyway.

As in the case of 'experience', 'construction' is not introduced explicitly as a technical term and so once more we are by default thrown back on the ordinary meaning of the word. This ordinary meaning has been outlined at the beginning of 5.1 above. Applying this to the present case we must ask first what the materials of the construction are supposed to be. Presumably 'experiences' ('sense-impressions', 'sense-data', or whatever). But the question of the intelligibility of the latter and then the question of the justification for introducing such an idea, assuming it has been assigned a meaning, has not been addressed. Second, since both plan-of-construction and end-in-view presuppose a constructor, critical attention may be focussed on this factor in the ordinary meaning of 'construction'. Hume, in one of the most poignant passages in the philosophical literature, admitted frankly, in a note at the end of his *Treatise of Human Nature*, that he could finally make no sense, in terms of his fundamental sense-impressions, of the self to which they are referred, since he could not identify any impression of a self. More generally, if reality is a construction in subjective experience, then each constructing self must be the construction of another such self, *ad infinitum*. Or, if this consequence is to be avoided, there must be an unconstructed constructor (a *constructor sui* as it were). Then

if so, why can there not be an unconstructed *object?* But this sort of metaphysical dialectic could be spun out indefinitely and should be postponed till constructivism has succeeded in assigning some intelligible meaning to the notion of reality's being the result of a subjective construction of or in experience.[6]

6.3. But is this too premature? It might be objected that since the paper says that the constructivist 'orientation was proposed by Vico at the beginning of the 18th century' (121). Vico is a so far neglected source for information about the idea of 'construction'.

6.31. The paper says that according to Vico

> epistemic agents can *know* nothing but the cognitive structures they themselves have put together....'To know' means *to know how to make*. ... one knows a thing only when one can tell what components it consists of. Consequently, God alone can know the *real* world, because He knows how and of what He has created it. In contrast, the human knower can know only what the human knower has constructed. (123)

This is unfortunately all that is said. Before commenting on it two things should be pointed out. First, it is not absolutely clear whether the author simply means to report Vico's views here, without necessarily endorsing them all, or whether it is also to be taken as a statement of his own views. Second, whatever light it might cast on the idea of cognitive construction in general, it does not mention anything about individual subjective experience, so that the bearing of the former on the latter must remain conjectural.

This having been said, it requires little more than a superficial reading to see that the passage presents a vertiginous array of problems of interpretation, only some of which can be touched on here.

(1) The second and third sentences seem to be the key ones: the first leads up to them and the last two are presented as consequences of them. But they do not hang together, either severally or in conjunction. Severally they are vacuous, because in the first 'to know' is explicated by a locution containing that verb essentially, and in the second 'know[s]' is explicated wholly or partly (it is not clear which) by a locution containing 'tell' essentially and this can only here mean 'know'. Looked at in conjunction, the second of the two sentences would seem to be meant as an explication of the first, but states in fact at most a necessary condition for it. In fact if 'tell' is read as something like 'identify' it plays no significant part in the satement as a whole.

(2) The first and last sentences would seem to go together, and read thus say that human knowers can know only 'cognitive structures'. Now on the face of it the latter phrase must surely mean something like 'conceptual structures', for 'real' structures, in the sense of extra-discursive ones, are surely not themselves 'cognitive', but are what 'cognitive structures' proper are used to know *about*. So it seems that human knowledge is restricted to concepts and their concatenation, whereas it has seemed so far that it is 'experience' that is known as well.

(3) Finally, the fourth sentence introduces what would seem to be an implicit contrast, namely, between '*real*' and something else, but does not even hint at what the contrast is with ('apparent' world, world of concept?) and the so far unmentioned idea of creation, which may most probably be taken to refer to that of bringing into being *ex nihilo*.

Again the analysis could be continued for some time, but there seems little prospect of seeing anything very clearly through this glass, dark as it is. So it will be better to turn to Vico himself, who, though a notoriously obscure writer, could hardly offer worse interpretative difficulties than the passage cited above.

6.32. Vico's basic theses, insofar as they bear on the present questions, may be put as follows.

1. Someone can know in the strict sense of the word (be in possession of *verum*, formulated in *scientia*) if and only if what is known is made by (*factum*) that knower, as regards both the elements and the relations that constitute it, where 'made' means brought about *ex nihilo*, 'created'.[7] (This will be called henceforth 'Vico's Principle', or generally 'VP' for short.)

2. Therefore only God can know everything, without exception; in particular, only God can know the natural world. This he does through the exercise of *intelligentia*.[8]

3. In general, human beings can at best attain *certainty* where the natural world is concerned, formulated in *conscientia*, through the exercise of *cogitatio*, about disposition of the elements of nature.[9]

3'. The qualification 'in general' in (3) alludes to the fact that Vico qualifies his thesis about the scope of human knowledge of nature in his remarks on experiment. However, his language is even less clear than usual at this point, and it is ultimately unclear what precisely he means. He says that experiment permits human beings to create (in some sense) new states of affairs in nature, and the most likely reading is that experimental 'knowledge' is supposed to lie somewhere between merely observational information and Divine knowledge proper.[10]

4. The conditions for knowledge proper, formulated in VP, are satisfied in the human domain at only two points, namely, (a) mathematics, and (b) 'the common nature of the nations', that is, matters social (including, of course, history).[11]

6.33. What light, if any, does 6.32 cast on the character of the constructivism in the paper being examined? Unfortunately, the answer can only be: at very best, precious little. It might be weakly conjectured that denial of the possibility of humans' knowing the really and truly real is related to (3) above, and hence ultimately on some version of VP in (1) and the consequence drawn in (2). As regards (3'), the paper does not mention experiment, nor is (4b) remarked upon. The most that it is possible to squeeze out is something perhaps in agreement with (4a) when it says of 'deductive inferences in logic and mathematics' that 'in Piaget's view' – and presumably according to the constructivism represented by the paper

– 'the certainty of conclusions in these areas pertains to mental operations and not to sensory-motor material' (129). So the detour through Vico has not resulted in an advance much closer to the goal of a reasonably clear presentation of constructivism, and in particular what 'construction' means in the case of 'individual subjective experience', on account of which recourse was had to Vico to start with.

7. The overall results of §§2–6, which have been devoted to an attempt to 'construct' a clearer picture of constructivism than is available in the paper under examination, have been very disappointing; it has not proved possible to clarify the doctrine to any significant extent. Indeed, in some ways it is more obscure now than at the outset, any intuitive intelligibility it may have had at the outset having evaporated along the path of a search for a more explicit understanding. So one is inclined to say of the doctrine what Falstaff said of Mistress Quickly:'Why? she's neither fish nor flesh; a man knows not where to have her'. Indeed it is like mathematics, at least in the way Russell once characterised it 'as the subject in which we never know what we are talking about, nor whether what we are saying is true' (Russell 1956, p. 1577). However, the next part of the discussion will be devoted to some critical discussion as far as possible independent of questions of presentation of the elements.

II

> What then shall we say to this?
> *Romans* 9:30

8. I propose to argue that Vico's conception of knowledge in the strict sense, as focussed in VP is, if 'knowledge' is being used here in any sense identifiably related to the ordinary range of meanings of the word, and not in some special sense which has not been made explicit, simply unintelligible. One main reason for this is that 'knowledge' in any ordinary, understandable sense of the word requires something other than the knowledge of which the latter can be said to *be* knowledge. Take, for example, Vico's example of mathematics, on which most have a better intuitive grip than the theological idea of creation *ex nihilo*. It is said that we can know this domain in the strict sense of VP because we make the truths it contains. But it does not make sense to call a pure posit an 'object' of 'knowledge': the person laying down the stipulations is doing just that, and this is no more 'knowing' than conferring a name on an infant is 'knowing'. Of course, there can be knowledge *that* such a posit has been made – or that such and such a name has been conferred – but this is obviously a quite different matter. Again, the posits having been made, it does not make sense to speak of 'inferring' from it (an axiom for example) unless the inferring is constrained by some rules, just as it does not make sense to say that someone is 'playing chess' if that person just

makes his moves as he pleases. Of course, the rules can be changed, but they do not become something we can be said to 'know' until the change has been made, and we cannot be said to 'infer' till the change has been adopted, however temporarily. Again, to take the conclusions derived by inferring from initial posits, these are no more 'true' (rather than correctly describable as, say: 'derived in accordance with the rules of inference and premises of the system used') than a winning end-game in chess is 'true'. We can talk of truth value once the system has been applied to some extra-mathematical subject matter, as in 'applied geometry'; but then human beings do not 'make' that subject matter, in its ultimate constituents anyway, and so, according to VP we cannot be said to have access to 'the true' and hence to knowledge. Similarly, in the case of 'the common nature of the nations', we can *decide* what is to be called 'just', say, and draw conclusions, but this does not vouchsafe any privileged cognitive access to that act (say) which is (correctly) called 'just', with respect to, for example, its actual consequences, which are not generated by that act qua 'just' any more than we can infer something about a man who is correctly called 'married' other than that he stands in a certain relation to a 'wife'.[12] Examples from other areas could be multiplied,[13] but they would only reinforce the contention that it is nonsense to talk of knowledge in the strict sense entailing creation of what is known or of an identity between knower and known. Rather, it does away with the idea of knowledge altogether, just as (to use Kant's image) though birds may well fly better the less the air-resistance, they could not fly at all if there were no air at all.

9. It may be worthwhile to consider what might be described as a more 'relaxed' version of VP, one where the actual 'creation' of the elements and relations are not in question. In this version knowing and making are said to be necessary and sufficient conditions for one another. Is this plausible?

9.1. Consider the matter from the side of knowing. First, it is obviously not sufficient, otherwise manufacturing would be cheaper than it is. But, second, is it at least a necessary condition? To make the discussion non-trivial, suppose it is assumed that a necessary condition for 'making' here is some sort of conscious intention, planning, intentionally used procedure, so excluding whittling (and much modern 'art'). Then suppose that a normally competent chemist sets out to synthesise a certain compound, but instead ends up with another (perhaps being thereby responsible for initiating a breakthrough in both knowledge and techniques of synthesis). Would it not be correct to say that he 'made' the substance he actually produced? To point the question, bringing it closer to Vico's concerns, consider a similar case in the historical field, one from the vast repertory of 'unintended consequences'. Vico is one of a number of thinkers about history who have devoted much attention to this theme, belonging to that line of thinkers who, rather than looking at the matter in secular fashion (e.g. Mandeville, Turgot, Marx) used the idea (like Bossuet and Hegel)

to reconcile genuine human agency and Divine Providence (Vico 1961, §1108, pp. 382f). But then, if the human agency is genuine, the act was not sufficient for knowledge of it and hence the latter not necessary for the former. (But if human agency is not, then the reconciling project founders.)

9.2. Let us look at the question from the point of view of the making. First, making is surely not a sufficient condition for knowing. For instance, Galileo made telescopes that were good enough to permit him to make path-breaking astronomical discoveries at a time when next to nothing of the optics of the instrument was known, and there was a similar situation with regard to the early modern steam engines *vis-à-vis* the principles of thermodynamics. Second, is making a necessary condition for knowing? It all depends, in particular on how closely associated the 'making' and the 'knowing' have to be for the one to count as a necessary condition of the other. For even if the two may in general be related, the relation may hold only by means of a very intricate and extended chain of steps. For example, there is no doubt that Euclidean geometry was ultimately derived from practical measurements of actual lengths, areas, volumes, but the path between the two was certainly a long one, and may never be at all fully reconstructed.[14]

10. Instead of looking for and at basic concepts and premises, the examination may be directed at consequences. If there is at least one of these that is in some degree intelligible, central, and also vulnerable to criticism, then, assuming that the argument, whatever it is, is valid, there can be some rational confidence that something is wrong further up the inferential line.

In looking for a starting-point of this sort it is hardly possible to do better than consider a spot that von Glasersfeld himself considers to be at least *prima facie* in need of defence, or at least of elucidatory amplification, namely, the question of intersubjectivity.

10.1. He writes:

> To make the Piagetian [= in effect, here, constructivist – WAS] definition of knowledge plausible, one must immediately take into account . . . that a human subject's experience always includes the social interaction with other cognizing subjects. . . . But introducing the notion of social interaction raises a problem for constructivists. If what a cognizing subject knows cannot be anything but what that subject has constructed, it is clear that, from the constructivist perspective, the *others* with whom the subject may interact socially cannot be posited as an ontological given . . . [constructivists] want to avoid assuming any cognitive structures or categories as innate. Hence there is the need to hypothesize a model of the conceptual genesis of 'others'. (126, 129)

10.2. Before the model in question is outlined and examined it may be noted that there is at least one not inconsiderable oddity in this passage, namely, the fact that it says that 'a human subject's experience *always* [emphasis added – WAS] includes the social interaction with other cogniz- ing subjects', whilst it also says that 'what a cognizing subject knows cannot be anything but what that subject has constructed', so that, since

'social interaction' presumably involves knowledge, each 'human subject' must construct 'other cognizing subjects', the consequence is (a) that the subject always experiences/knows other subjects and also (b) that there is a time (namely, that before the construction of others is completed) when the subject does *not* experience/know others. If this is not a self-contradiction then it may serve as an example of such until a better one presents itself. In the fairy story we read that, though in an impossible situation, 'with one bound Jack was free'. We must await Jack-the-constructivist's self-emancipatory leap here.

10.3. Let us turn to the 'model' of how the individual subject is supposed to 'construct' others. Well, once upon a time in every very small child's life it begins to construct concepts of objects – or rather of 'objects':

> On the sensory-motor level, the schemes a developing child builds up and manages to keep viable will come to involve a large variety of 'objects'. There will be cups and spoons, . . . rag dolls and teddy bears – all seen, manipulated, and familiar as components of diverse action schemes. (129)

But, furthermore,

> there may also be kittens and perhaps a dog. Though the child may at first approach these items with action schemes that assimilate them to dolls or teddy bears, their unexpected reactions will quickly cause novel kinds of perturbation and inevitable accommodations. The most momentous of these accommodations can be roughly characterized by saying that the child will come to ascribe to these somewhat unruly entities certain properties that radically differentiate them from the other familiar objects. Among these properties will be the ability to move on their own, the ability to see and hear, and eventually also the ability to feel pain. The ascription of these properties arises simply because, without them, the child's interactions with kittens and dogs cannot be turned into even moderately reliable schemes. (129f)

10.4. Now it is difficult to know where to start in criticising this, such is the *embarras de choix*. At any rate, many of the points will have to be made quite summarily, though reference will be made to places where the argumentative underpinning is presented more fully.

10.41. If the concept of object, or of 'object', is to be constructed then there must be some pre-'object' concept or concepts *from* which it is constructed. Presumably this conceptual material refers to individual sense contents: 'sense impressions', 'sense data' have been among the terms traditionally used for the latter. But there are powerful arguments, stemming more recently mainly from Wittgenstein, to the conclusion that there is no sensation language (as it may be called) independent of and prior to object language, but that insofar as the latter exists at all it is 'parasitic upon' the latter. Much earlier, Kant argued, against Hume in particular, that 'experience' is inherently intersubjective or object-related.[15]

10.42. Essentially the same point can be looked at from a slightly different direction. If there were to be pre-object experience then it would presumably have to be the experience of some subject, some self. But, as already mentioned, Hume himself frankly admitted that he could not accommodate such a self within his system in which 'impressions' are

fundamental. Kant (on whom von Glasersfeld calls in another, related regard, 130) argued that empirical subjects necessarily presupposed empirical objectivity.[16]

10.43. Again, it has been strongly argued by many philosophers[17] that, far from its being the case that the individual subject ('I', 'ego') 'constructs' or 'infers' other such, it is rather the *community* of subjects/others that constitute individual subjects, or, better, that self and other are correlative. But there are no others at this stage of the story which is, in fact, being told in order to try to explain how the idea of others comes to be.

10.44. Apart from what has been said so far, the whole constructivist story so far is still circular, since the story of the alleged process of construction assumes precisely what is supposed to be being constructed. For instance, how could the child 'assimilate' kittens and dogs to rag dolls and teddy bears unless it already had a concept of items of the first sort as being different? (Set aside here is the question of the plausibility of ascribing such a complex, sophisticated process to a small child.) And why should it conceive kittens and dogs significantly differently from rag dolls and teddy bears in the respects listed? If we are dealing purely with what belongs to the level of external phenomena (and consistency with the program of constitution makes this mandatory at this stage) then nothing about what we call 'kittens' and 'dogs' requires the postulation of self-movement, ability to see and hear and feel pain. All this presupposes what has been traditionally called an 'analogy argument', which not only has been completely discredited,[18] but is one which is merely risible to imagine a child able to construct.

10.5. Finally, there is said to be 'a very similar development' (that is, to the one set out in 10.3 above) to

> the child's construction of schemes that involve still more complex items in her experiential environment, namely the human individuals who, to a much greater extent than other recurrent items of experience, make interaction unavoidable. . . . Here again, in order to develop relatively reliable schemes, the child must impute certain capabilities to the objects of interaction. But now these ascriptions comprise not only perceptual but also cognitive capabilities, and soon these formidible 'others' will be seen as intending, making plans, and being both very and not at all predictable in some respects. Indeed, out of the manifold of these frequent but nevertheless special interactions, there eventually emerges the way the developing individual will think both of 'others' and of him- or herself. (130)

Nothing essential needs to be added to the considerations set out in 10.44 above, for, *mutatis mutandis*, they apply here too. If the gap between what we have available for 'construction' and what is supposed to be constructed is obvious enough there, then here it becomes a 'dark unbottom'd infinite abyss'.

11. It is necessary now to look at the constructivist account of language acquisition both for its own sake and because it bears very closely on the subject matter of §10. It is written:

> From the constructivist point of view . . . language users must individually *construct* the meaning of words, phrases, sentences, and texts. Needless to say, this semantic construc-

tion does not always have to start from scratch. Once a certain amount of vocabulary and combinatorial rules ('syntax') have [sic] been built up in interaction with speakers of the particular language, these patterns can be used to lead a learner to form novel combinations and, thus, novel conceptual compounds. But the basic elements out of which an individual's conceptual structures are composed and the relations by means of which they are held together . . . must be abstracted from individual experience; and their interpersonal fit, which makes possible what we call communication, can arise only in the course of pro-tracted interaction, through mutual orientation and adaptation . . . (132)

12. The following are some critical comments on this passage.

12.1. There seem to be at least two quite different accounts of language acquisition here. (a) According to one language users must *individually* 'construct' meanings. Now since there is a trivial sense in which this is true (they must individually acquire language just as they must individually learn to knot a tie or drive a car, since only 'I' can do anything that is 'my' doing) it may be worth remarking that this is clearly meant in a non-trivial sense. That this is so emerges already from the statement that this construction 'does not always have to start from scratch'. For if it does not 'always' have to do so, then it may at least sometimes do so. So in the basic sense language acquisition is individual in the stronger sense of arising 'from scratch', or *ex nihilo*, as we might say, remembering the shadow of Vico. Nothing innate can be assumed. (b) But then it is said that an initial fund of semantics and syntax is 'built up in interaction with speakers of the particular language'. But perhaps what is meant is that this occurs in those cases when the individual learner does not 'start from scratch'. Anyway, let us consider both possibilities.

12.2. To take (b) first, something very strange immediately emerges once it is recalled that the passage also says that the 'interpersonal fit' between individually constructed languages 'which makes possible . . .com-munication' depends upon 'protracted interaction . . . mutual orientation and adaptation'. Now it seems to follow from this that the initial 'interac-tion with speakers of the particular language' which is a presupposition of the construction of a basic semantics and syntax must occur *before* 'communication', or, still more explicitly, that learning language with the help of others occurs before communication with others. Who can make anything of this?

12.3. According to account (a), semantic and syntactic 'basic elements' are (i) 'abstracted' from (ii) 'individual experience'. Now there are many problems here, major ones clustering about the aspects of (1) abstraction, (2) individuality and (3) experience.

12.31. The received discussions of 'abstractive' theories of concept for-mation are made up of a number of threads, many of which are indepen-dent of one another, as, for example, those concerned with the abstractive theory specifically of generic concepts and with psychologistic theories. One perhaps most relevant here, and going to the heart of the matter, is the following: abstraction theories in general are essentially circular be-cause the alledged process of abstraction already *presupposes* the concept

which is supposed to be formed as a *result* of that process. For example, if I am supposed to learn the meaning of 'red' by 'abstracting' the common property 'redness' from various items that are red, this assumes that I can already form a class of 'red' things from which the abstraction can be made. But this clearly assumes that I am competent to distinguish red things from others. Or, if we imagine the class already formed it assumes that I can pick out *that* common property rather some other, since any group of objects at all possesses a *number* of common properties. The situation is not changed in principle if, going beyond the individualist context, we imagine that someone exhibits an instance of a property the word for which it is desired I should learn (points to a *red* object, makes a *loud* noise, and so on): the process of so-called 'ostensive definition'. But here too, since anything always instantiates different concepts at the same time, I must already have at least a rudimentary command of the concept intended if I am to realise what is meant.[19]

12.32. The last consideration already introduced others into the language-learning process, and it is at least one strand of Wittgenstein's much-discussed analysis of the idea of a 'private language' that the latter, interpreted strictly is impossible (certainly as a 'first' or 'basic' language, as it were, as distinct from one which I might make up for a special purpose – for example, writing a diary in – but which would depend on a more fundamental one). This is (roughly) because to have a language in any genuine sense of the word requires that I achieve consistent reference, for the most part at least: a system of markers (written, auditory, etc.) that did not 'mean' much the same thing for most of the time not only could not be used to communicate with others, but could not be used by me to communicate with myself. So a community of language users is necessary to provide the possibility of intersubjective checks on consistency of reference.[20]

12.33. Furthermore, a second strand in Wittgenstein's private language argument connects with the third point of focus of problems identified at the beginning of 12.3, namely, the constructivist idea that basic concept formation is not only abstractive and individualist, but also takes place in the field of experience. For Wittgenstein argues, in effect, that consistency of reference presupposes not only a fairly stable world to which reference may be made, but also a commonly accessible, public world to which recourse may be had for purposes of checking consistency of reference.[21]

12.4. One last point may be made about this question of the relation of language and the experience of a unified and differentiated world. This is that there is excellent scientific material pointing to the conclusion that a fully coherent experience of such a world depends on at least some mastery of language,[22] and that hence any account that separates such symbolic processes and intersubjectivity must be seriously astray.

13. At this point we may pause to notice that there is a common feature in the paralogisms exhibited so far in this part of the examination, namely,

a pervasive *inversion* of *terminus a quo* and *terminus ad quem*. These inversions are mainly the following:
1. of sensation and object;
2. of ego and object,
3. of ego and others;
4. of abstraction and possession of concepts;
5. of individual language-acquisition and intersubjectivity.
All this might cause us to be reminded of the slogan quoted with approval from Piaget: 'intelligence organizes the world by organizing itself' (136). If we must have a slogan, then let it be rather: 'intelligence organises itself by organising the world'.

    14. Finally, coming right back to the beginning again, we saw (3.2) that, in the paper being examined, two notions of objectivity are distinguished, namely, one relating to the world and the other to intersubjectivity, and that constructivism in effect proposes to drop the first whilst keeping the second. The burden of the examination so far is that this is impossible, and that to take the first step, in the direction of 'subjective reality', is to enter upon the path to 'the undiscover'd country from whose bourn/No traveller returns . . .'

III

> Confusion now hath made his masterpiece!
> *Macbeth*, II.iii:72

15. For crime stories to be really satisfying it is necessary that they not only reveal the villain, and the course of the process of inquiry that led to that discovery, but also how the villain came to commit the crime in the first place. Similarly, a critical examination of an intellectual position is the more satisfactory to the extent that it not only reveals errors but plausibly shows how they came to be made, not, moreover, in merely individual terms (which are generally fairly uninteresting from the point of view of the history of ideas) but in more objective ones. So, having now concluded the present critical examination in the first mode, I want to turn to the second. In the nature of the case this cannot be as compelling as the first sort can be, at its best anyway, but may be at least suggestive and even have some independent value.

    16. If to start with we look once more at 'Vico's Principle' ('the true' and 'what is made' are interchangeable) probably the first thing that will strike most, after its meaning and implications have been spelled out, is what an extraordinary one it is. For it is an epistemological criterion that allows as genuine knowledge of the natural world only God's, that, in the end, bases knowledge of socio-historical matters on revelation of the

character of Divine Providence, and allows to human beings by way of knowledge in the strict sense only mathematics.

Now students of philosophy are used to its practitioners' saying extra-ordinary things and may often be grateful if what is said is just (perhaps even with the help of a sympathetic reading) intelligible. Of the many different sort of responses to philosophers' utterances, one extreme one is to regard those making the statements as just more or less harmless lunatics, whilst another, at the opposite extreme, is to learn not to notice any more how very strange the doctrines are, perhaps even to the extent of eventually saying things of a similar sort. Now an approach lying somewhere between both, to be recommended especially when the philo-sopher making such statements seems to be otherwise reasonably bal-anced, and perhaps even often makes penetrating remarks, is to follow that 'rule of charity' that we would normally follow if someone we knew to be intelligent and level-headed were to say things we thought very curious indeed, or to act in a way we thought inappropriate in the circum-stances, that is, to ask whether we had really understood the *point* of his words or behaviour, and whether, this having been grasped, his words or behaviour might not now seem quite intelligible to us, and not merely perverse, even if that rationale might still seem so, or at least unaccept-able. In the case of a philosopher we should often regard some or all of his doctrines as determined by a 'hidden agenda', as answers not to overt questions but to covert ones of the sort: What answers to the former sort will produce cognitive effects which advance the cause of a predetermined position?[23]

In the case of Vico, once we ask *this* sort of question a plausible answer is fairly obvious. For VP is tailored, as it were, to the end of securing knowledge of the real world, natural and social, for Christian belief, leaving mathematics to human beings, since, as Hobbes said of geometry, 'men care not, in that subject, what be truth, as a thing that crosses no man's ambition, profit or lust . . . not . . . contrary to any man's right of dominion, or to interest of men that have dominion' (Hobbes 1651, p. 91). And, looking at the matter from the point of view of Vico as an individual, the result agrees perfectly with everything we know of his basic theological orientation.[24]

But this has still not got to the heart of the matter, for if we carry our 'sifting humour' further we must ask why it was necessary to try to secure Christian belief just at this time. Again, the question almost answers itself once it is posed. It is indeed given very explicitly in a work of similar orientation, though containing different doctrines, published in the same year as Vico's *De antiquissima Italorum sapientia* (1710), namely, Bishop Berkeley's *A Treatise Concerning the Principles of Human Knowledge*, which bears the subtitle: *Wherein the Chief Causes of Error and Difficulty in the Sciences, With the Grounds of Scepticism, Atheism, and Irreligion Are Inquired Into*, or still more succinctly in the same author's *Three Dialogues Between Hylas and Philonous*, published three years later,

which announces on the title-page that the work is *In Opposition to Sceptics and Atheists*. In short, Vico's epistemology makes sense if seen as a battlefront in the bitter struggle of Christianity against the 'New Sciences', or, at least against what many took to be philosophical consequences of the latter at best simply unwelcome to Christianity and at worst inconsistent with it.[25]

17. Now it might be objected to all this (a) that Thomas Hobbes held a view essentially similar to VP, (b) that Hobbes's views were not inspired by theological considerations, that he was in fact a leading philosopher of the 'New Sciences', and (c) that Vico knew of Hobbes's work and even remarked upon its affiliations with its own.

With regard to this, (b) is certainly incontestable. Of (c) it is true that Vico knew of Hobbes's writings, but what he remarks upon concerning the nature of their common ground does not include VP, and the criticism he makes of him concerns precisely Hobbes's lack of a theological basis for his account of the history of society.[26] All this by itself would make necessary a questioning of the truth of (a). To do this it is indispensable to have at least a brief outline of Hobbes's thought on the relevant issues before us. This may be set out as follows.[27]

1. Science (*scientia*) is concerned with the truth of general propositions.
2. General propositions are ones about 'consequences', that is (so the point may be glossed), general propositions are conditionals.
3. When it is a matter of the truth of a fact we speak simply of knowledge (*cognitio*).
4. The content of science (that which *scimus*) is 'knowledge from causes, or in other words (*sive*) derived from a generation of the subject-matter (*subjecti*) by means of a correct (*rectam*) argument'.
5. The means by which we know in the scientific sense (*scimus*) to the greatest degree possible that a theorem is true is knowledge derived by means of a legitimate (*legitimam*) argument from experience of effects.
6. Both derivations are wont to be called 'demonstrations', but it is better to use this term for the first (5) because it is better, wherever possible, to use causes that are present rather than ones which are irrevocably in the past.
7. Therefore, science *par excellence* is that available to humans *a priori* by virtue of the fact that the generation in question depends on their own will (*arbitrio*).
8. Geometry is a body of items that may be demonstrated (*demonstrabilia*), for it treat of figures that we ourselves create (*creamus*).
9. 'On the contrary, since the causes of natural things lie not within our power, but in that of the divine will, and since the greatest part of them . . . is invisible, we cannot deduce their properties from causes'.[28] Nevertheless, 'from the properties of them that we do see, we can, by deducing consequences, go so far as demonstrating that this or that may be their causes. This sort of demonstration is called *a posteriori*,

and the science itself, physics'. Thus genuine (*vera*) physics, which depends upon (*innitur*) geometry should be included among branches of (mixed) mathematics (*mathematicas mixtas*)', for it is usual to call 'mathematics' those sciences that are taught 'not by practical use (*usu*) and experiencing but by teachers and by rules', and thus 'pure' mathematics is that which treats quantities *in abstracto*, there being no need of knowledge of a particular subject-matter (*subjecti*), whereas 'mixed' mathematics are those where such knowledge is required.

10. Politics and ethics, that is the science of just/unjust, equitable/inequitable, can be demonstrated *a priori* because the principles by virtue of which what these are are known, that is, their causes, namely, laws and agreements, we ourselves make (*fecimus*).

18. If this account and Vico's are now compared it will be seen that they are fundamentally different.[29] Though Hobbes speaks of 'generation', and though this is absolutely central to his views here, it must be emphasised that this is not at all the same as Vico's 'making', even if the two terms may seem to be at least very similar in meaning and even overlap in this respect at the point now in question. For Hobbes's 'generation' is *intra*discursive, its being a matter of the development of a subject-matter from – ultimately – definitions, whilst Vico's 'making' is, at least as regards nature and the socio-historical domain, *extra*discursive. The character of Hobbes's view is probably somewhat obscured, for modern readers anyway, by the fact that he uses 'cause' in such a way that it covers both what we might call today 'reason' and also real cause.[30] (Perhaps 'explanation' in current usage has some of this ambiguity.) Still, 'causes' here are *internal* to discourse,[31] even if they in some sense correspond to real causes. Mathematics on the one hand, and politics and ethics on the other, belong together for Hobbes not because we generate or make the subject matter of both (the ideal objects of the one and the real objects of the other), but because we generate or make the ideal objects of both, in such a way that there is no gap between nominal and real essences, as it were, here, whereas this is not the case in physics. Hobbes does not deny that there is a science, in his strict sense, of physics, only that there is no *a priori* science of physics. From knowledge of effects physics can strictly demonstrate a disjunction of possible causes, but cannot pick out *a priori* which of these disjuncts is, in such and such a case or type of case the actual one. Though he does not say explicitly that this task of determining actual causes from a set of possible ones falls in the domain of empirical inquiry, that is presumably his view.[32]

19. Furthermore, it should now be clear that Hobbes's view here is an inheritance from Galileo, rightly regarded as the founder of modern natural science as regards its method (insofar as there is a single 'founder') and the central figure therein substantively.[33] Hobbes takes his central ideas in this regard from Galileo but in return clarifies and generalises them, making them available for philosophical thought in general. To sharpen this claim let us recall the principal features of Galileo's approach.

This may be best done by bringing them into relief against the Aristotelian approach he combatted.[34]

According to the latter, (1) the subject matter of science is ultimately the world as ordinarily perceived and its task the recording of what is the case there 'always or for the most part' (*Met.* 1026b28–1027a28). (2) The task of this recording is taken on by generic (class-) concepts, abstracted from the world as ordinarily experienced and underpinned by 'formal' (in general equivalent to final) causes.

For Galileo, (1) the everyday world simply does not immediately exhibit significant regularities, far less necessary coexistences and sequences. Rather, it has to be interfered with instrumentally (experimentally) so as to produce systems as closed as far as possible against certain causal factors: only in such relatively isolated systems is there the possibility of observing invariant behaviour. But the indispensable guide for this practical interference with the actual, which makes the basis of physics not so much perceptual as experimental experience, is (2) a set of special concepts, which must be formed, in the order of knowledge, in advance of experiment, concepts that refer to purely hypothetical situations and thus cannot be 'abstracted' from experience of the ordinary world. They are not generic but rather relational concepts expressing not 'formal' or 'final' causes but *conditions*, realised in 'efficient' causes, the totality of which constitute the state of affairs in question. The instances of such concepts do not simply stand side by side, as it were, as in the case of generic concepts, but are related to one another by strict rules of dependence. Experiment on the one hand, and concept and theory formation on the other hand, are reciprocally related.[35] The latter guides the former, but the former is the ultimate judge as to which of the in principle competing reconstructions in theory of the actual from different sorts of analytical concepts and principles (which 'composition' from a preceding 'resolution') is the more adequate. In sum, Galilean methodology is constructivist in at least the following ways: (1) it involves the practical (re)construction of the actual world in experiment; (2) it involves a construction of concepts in the sense that it cannot make do with ones that are formed in a more or less spontaneous way in everyday life but must tailor ones suited to the representation of situations which do not spontaneously occur in quotidian experience, but have to be experimentally produced; and (3) still within the domain of concepts, these govern fields the particular items in which can be 'constructed' one from another by the use of rules that generate series. Indeed, bringing all three points together it may be said that the ultimate point of the enterprise of physics is the transformation of a merely 'empirical' manifold of simply coexisting or successive elements into a 'constructive' manifold of elements that are related by strict functional rules.[36]

Though Hobbes does not take up all the features of Galileo's methodology, sufficient essential points are there to make the genealogy unmistakeable: the province of science defined as the field of 'consequences',

that is conditionals, rather than categorical statements about what is actually the case,[37] the consequent distinction between the realms of the intra- and extra-discursive, the conception of theory as providing a repertory of possible causes of given effects, the rejection of 'formal'/'final' causation (Hobbes 1656, Pt II, Ch. X, §7).

20. It only remains to draw the conclusion, foreshadowed at the beginning of §17 above, that 'Vico's Principle' and Hobbes's methodology are quite different in principle and confusion between them is at least partly the result of an attention to words rather than to what they mean.[39] They are not only systematically (conceptually, theoretically) quite different but (not unconnected with this of course) belong to quite different historical lineages, Vico's to traditional Catholic theology, Hobbes's to early modern science.[40] (That the personal affiliations of each philosopher were correspondingly different is also true.) Each belonged to a different part of the contemporary field of ideas, Hobbes to the intellectually revolutionary spirit of the new sciences, Vico to the conservative front against the latter.[41]

21. Finally, let us return to the doctrine called 'constructivism' which was the main subject of examination in the first and second parts of this paper. We can ask whether the considerations of the third part have provided any resources for suggesting a diagnosis or aetiology of the problems it has been shown to face, even for sketching a proposal as to the way in which, systematically speaking anyway, it came to be 'constructed'. This must be an enterprise with conclusions that are tentative at best, but for what it is worth the following is suggested.

According to traditional empiricism,

(1)   the direct object of knowledge is given to the individual subject in experience.

Now Kantians and others had long insisted that this involved what was called in the mid-fifties (Sellars 1956) a 'myth of the given', and a great many otherwise empiricist philosophers began scrambling belatedly aboard the new bandwagon that had inscribed on its side the following words:

(2)   The object of knowledge is not 'given' directly to the individual subject in experience but only via 'theoretical constructs'.

At this point it is only necessary to confuse the object of knowledge, that is, the experience of the individual subject, with the means necessary for knowing about this object, that is, constructs, namely objects of 'construction', to arrive at the following position:

(3)   The experience of the individual subject is a 'construct', a result of 'construction'.

So, by a sort of intellectual prestidigitation there results from (1), which can be assigned some sort of sense, and (2), which is intelligible enough

(once explained, anyway), (3), which is not comprehensible.[42] But that words which are individually meaningful can be put together according to legitimate syntactical rules to obtain not just sentences that are obviously unintelligible but also ones which, if not obviously such, can be shown to be so, should come as no surprise to students of the history of ideas.

22. In conclusion, I suggest that the whole preceding examination points to the following outcomes. Firstly, much of the doctrine called 'constructivism', as presented in this paper (especially in the first and second parts) is simply unintelligible. Secondly, to the extent that it is intelligible enough to provide some foothold for understanding and criticism it is simply confused. Thirdly, there is a complete absence of any argument for whatever positions can be made out. In all these respects certain words and combinations of words are repeated like *mantras*, and while this procedure may well eventually produce in some what chanting is often designed to do, namely, produce a certain feeling of enlightenment without the tiresome business of intellectual effort, this feeling nearly always disappears with the immersion of the head in the cold water of critical interrogation. Fourthly, the key problem of intersubjectivity is not successfully addressed. In general, far from being what it is claimed to be, namely, the New Age in philosophy of science, an even slightly perceptive ear can detect the familiar voice of a really quite primitive, traditional subjectivistic empiricism with some overtones of diverse provenance like Piaget and Kuhn.

It is possible that this gallimaufry might somehow inspire sounder work by others – perhaps stranger things have happened in the history of ideas – maybe by virtue of a vague resonance suggesting sounder ideas about 'construction' and so forth, but it is more likely to sidetrack thought and lead it to dead ends through its obstructing the posing of the right questions.

It may be claimed that, even if the presentation of constructivism examined here is indeed imperfect in certain ways, still there are others that do not have these failings. To that the only reply can be the one given by the people in the Greek fable to the man who boasted how far he had once jumped on the distant island of Rhodes: *Hic Rhodus, hic salta!*

NOTES

1. It may be worth noting, in order to avoid any misunderstanding, that Dr von Glasersfeld's 'constructivism' does not have anything to do, systematically anyway, with the doctrines covered by the same name stemming from what used more commonly to be called the 'Erlangen school', and also often called 'protophysics', all these largely deriving from the work of Hugo Dingler. For a brief survey of the latter's work and a comprehensive bibliography see Dingler 1987, and on the former, e.g. Böhme 1976 and Butts & Brown 1989.

2. See Pseudo-Dionysius, *Divine Names* and *Mystical Theology*, and John Scotus Eriugena, *De Divisione Naturae*, especially 1, 13 & 14.

3. There is a problem of interpretation alluded to here which must be left simply noted as such. The paper speaks of 'the thinking organism's cognitive isolation from "reality"' (121), and this must surely mean that 'the thinking organism' cannot know something about the world in general, for you can hardly be said to be 'isolated' from something that does not exist (though of course you can believe falsely that you are isolated from such). This is a form of scepticism. But the paper rejects scepticism (135), urging that constructivism evades this doctrine, and unless it does so by the trivialising move of simply defining it away by a stipulation regarding the meaning of the word 'knowledge' it is hard to see how to reconcile the two assertions.

4. For the lexicographical facts here see the *OED* and Williams 1983 s.v. 'empiricism' and 'experience'. (Dr Johnson's Dictionary, referred to above, has no pagination.)

5. Denial, or, at the very least, a heavy qualification on such intelligibility is in a sense the theme of an important part of Wittgenstein's later philosophy. (Since Wittgenstein's writings very seldom contain neat, definitive formulations of his positions and arguments, which have to be 'constructed' from different passages, it is more convenient, in a paper like the present, which is certainly not in any sense on Wittgenstein, but does refer to him at a number of places, to call upon sound secondary literature. For the present point see, e.g., Pears 1988, Ch. 11.) For an excellent recent refutation of Berkeley's arguments (if they can be called such) see Stove 1991, esp. pp. 139ff.

6. It may be noted here, in case Berkeleyan ideas were to be in the background in this area, that it is a vulgar misunderstanding of the Bishop's thought to ascribe to him the idea that individual subjects 'generate' or 'construct' their experience. Certainly their perceptions exist 'in' their minds (whatever that means) but their cause is 'the *immediate* hand of an *almighty* agent' (*Principles of Human Knowledge*, §CLI – and many other places in the same work).

7. Vico 1988, pp. 45, 46, 47, 56, 59, 64, etc.

8. On *scientia* vs *conscientia* and *intelligentia* vs *cogitatio* (see the following (2) and (3)) see Vico 1988, pp. 46f, 55.

9. Vico 1988, pp.48ff.

10. Vico 1988, pp. 52, 60, and cf. p. 97: 'as God is nature's artificer, so man is the god of artifacts'. (It is not easy to understand Vico's position on experiment, for here human beings surely only rearrange – ultimately – parts of the nature they do not make. If 'we cannot prove physical facts from causes, because the elements of natural things are external to us' as Vico says, 1988, p. 65, how is this changed in the experimental situation?)

11. On (a), Vico 1988, p. 65, and on (b) Vico 1961, §§331, 349, pp. 53f, 62f.

12. For some sound critical voices opposed to the recent choruses of praise for Vico, see Zagorin 1984 and Gaukroger 1986.

13. For instance, it used to be quite widely held that we could have incorrigible knowledge formulated in first person, present tense statements 'about' 'mental' conditions like pain, because – so it was often alleged – there is here no distinction between knower and known. But this is incoherent. For if 'I am in pain at *t*' is necessary and sufficient for 'I know that (I am in pain at *t*)' then the part of the second sentence in brackets can be replaced by the whole of that second sentence, and on *ad infinitum*.

14. On the 'prehistory of theory' in general see the very interesting and instructive Blumenberg 1987.

15. See Pears 1988, esp. Ch. 11. Also Austin 1962. (Kant's doctrine here has been widely misunderstood, to some extent because of the distinction he introduced in his *Prolegomena* (§18) between 'judgments and perception' and 'judgments of experience', obviously in the interests of popularisation, but in fact only muddying the waters, his presentation's being commonly misunderstood to mean that the first somehow precede the second.)

16. See, for example, 'the Refutation of Idealism' in his *Critique of Pure Reason*, B274ff.

17. See, for example, Hegel, *Phenomenology of Spirit*, Ch. IVA and Mead 1934.

18. See, for example, Malcolm 1958.

19. The 'abstraction' theory of concept formation goes back at least to Aristotle – see here the exhaustive presentation in von Fritz 1964 – and has been a standard one since. For a criticism particularly of psychologistic versions see Husserl 1970, pp. 337ff. The general circularity objection might be traced back at least as far as Frege, *The Foundations of Arithmetic*, §23; certainly it is developed in full in Cassirer 1923, Ch. I. See also Wittgenstein 1958, Part I, esp. 27ff.

20. See Pears 1988, Ch. 13–15. (There is a passage in the paper on pp. 130f – beginning 'that we impute the cognitive capabilities' and ending 'reality we have constructed' which might be read as a dim apprehension of Wittgenstein's point, but it is really hard to tell.) On the general question of the social context of thought and language see Vygotsky 1962 and Wertsch 1985.

21. See note 20 above.

22. See Cassirer 1959, Pt II, Ch.VI and 1985.

23. A methodology of 'question and answer' was presented by Collingwood in his 1939, Ch. V for use in historical studies in general. It jibes perfectly with something he could not have had in mind, namely, Althusser's theory of ideology. See, e.g., Althusser 1969, pp. 67ff and Althusser and Balibar 1970, pp. 52ff.

24. One illustrative passage must here stand for many. St Augustine writes: '. . . in illius [*sc.* Dei – WAS] naturae simplicitate mirabili non est aliud sapere, aliud esse; sed quod est sapere, hoc et esse.' (*De Trin.* XV, 13, 22). Cf. Aquinas, *S.T.* I, 14, 8. Berlin 1976, p. 117 says: 'it seems clear that the *verum/factum* doctrine is mediaeval and Christian and, by Vico's time, a theological commonplace. Also Löwith 1968, 8ff. Nicolas of Cusa already has the analogy between God's creation of the world and the human creation of mathematics. See Cassirer 1922, I, 38f, 45ff.

25. There is obviously no question of going into detail here. For some of the relevant information see, for example, Jacob 1988, Lefèvre, esp. pp. 54ff.

26. Vico simply says (1961, §179, p. 28) that Hobbes, like he himself, attempted 'the study of man in the whole society of the human race'. For the criticism see *loc. cit.*

27. Hobbes's thought here is probably most often presented in terms of a passage at the beginning of his 1656a (pp. 183f). But this is too condensed to be intelligible without a good deal of commentary and I have chosen instead to use his 1658, Ch. 10, §§4, 5, which is brief yet relatively self-contained and is, moreover, his last presentation. (The work seems not to be have been translated into English, so the slight paraphrase and translation is my own.) See also Hobbes 1656, esp. Chs I & X, and also parts of Hobbes 1660.

28. I am not quite clear what exactly Hobbes means here, and, more specifically, whether he means that not we but God creates natural causes or that only God has power over them; the coupling of this reference to God with the point of their being too small for us to see (recalling Locke, e.g. *Essay*, IV.iii.25) is curious.

29. Barnouw 1980 argues a continuity between them.

31. Cf. Descartes: 'causa sive ratio' (*Replies to the Second Set of Objections*, Ax. I), Spinoza: 'causa seu ratio' (*Ethics*, I, 11).

31. See Hobbes 1660: 'Qui figuras definiunt, Ideas, quae in animo sunt, non ipsa corpora respiciunt' (p. 87); 'Divisio est opus intellectus, intellectu facimus partes . . . Idem ergo est partes facere, quod partes considerare' (p. 56).

32. So Descartes see the exposition in Cassirer 1922, I, pp. 469ff.

33. The question of Hobbes's intellectual affiliations is more complicated than this, of course, but a more complete treatment would not displace the point made. Such a treatment would have to take into account Hobbes's relation to Bacon whose well-known thesis 'scientia et potentia in idem coincident' is echoed almost to the word in Hobbes (1656, Ch. I, §6). It would also have to treat the much neglected topic of Locke's approximately contemporary account of morals as a demonstrative science, based on his distinction

between 'ectypes' and 'archetypes'. On the whole matter see his *Essay*, II.xxxi.13 & 14, III.xi.15–17, IV.iii.18, IV.iv.5–7, IV.xii.8. On more general related questions see Baruzzi 1973.

34. The following approach to the Galilean revolution has been decisively influenced by, among others, the following: Böhme, van den Daele, Krohn 1977, Cassirer 1922, Lewin 1935, Mittelstrass 1970 (see also the report on this in his 1972).

35. See the excellent Tetens 1987 affiliated to Dingler, esp. 1928 and 1952. There is a convergent treatment from the totally different perspective of Marxism in Raphael 1974, pp. 94f.

36. I take this formulation from Cassirer 1959, 406ff.

37. It is hardly possible to exaggerate the significance of this breaking of the nexus between science and what is actually the case at certain places and times: echoing Hilbert's famous remark about Cantor's work on the infinite, it created a paradise of free theorising from which nothing has been able to expel science. In particular it shows how conservative, how divorced from the meaning of the real character of the new science was Hume and his 'constant conjunction' theory of cause. For explicit statements by Galileo on the purely hypothetical character of theorising as such see, for example, the *Two New Sciences*, Day III, first paragraph of 'On Naturally Accelerated Motions' and the closely related letter to P. Carcavy of 5 June 1637 (Galileo's *Opere*, 17:90).

38. It is also very probably a result of something like the following line of reasoning. (a) A great deal of Vico's work on history is very valuable. (b) Vico's work on history is, partly anyway, founded on VP (that is, the latter is a necessary condition for the former, so that the former is a sufficient condition for the latter). (c) Therefore, from (a) and (b) it follows that VP is worthy of endorsement. But though (a) is true, (b) is not: VP is an extraneous metaphysical gloss on the historical work as such. So the argument gives no grounds for believing (c). – It might be added here that, contrary to not a little loose talk about the relation of VP to Marxism, there is not a single passage in Marx's writings that can be adduced as even the most indirect support for this. Of the three references to Vico in the Marx-texts now available, two of them (letters to Lassalle and to Engels of 28 April 1862) are quite brief remarks on particular historical points, and the third (in the course of the fourth footnote to Ch. XV the English edition of the first volume of *Capital*) simply records a banality.

39. It may be remarked that this sort of confusion between two or more intellectual formations is by no means a rare phenomenon in the history of ideas, and sometimes works for good, sometimes for ill. But it has not, so far as I am aware, been given a name, and I want to propose one here, taken from the distant domains of mineralogy and geology. These sciences are familiar with the phenomenon of minerals that have the crystal form of one species but the chemical composition of another. (Examples are malachite/cuprite, barite/quartz, limonite/pyrite.) The one is called a 'pseudomorph' of the other, and the two are obviously easily confused in the absence of deeper, chemical analysis. The analogous situation, where the same or very similar *words* are attached to different *concepts* (and similar *sentences* to different *propositions*), leading to confusion between the one and the other, I propose to call 'cognitive pseudomorphs'. (After writing the preceding it occurred to me that the latter was probably the effect of a subconscious memory of the general historical notion of 'pseudomorph' in Spengler 1926–28, where it is explicitly introduced at I, p. 189. Examples will be found at I, pp. 209–12, 214, 216, 228, and II, pp. 74, 189, 190, 191, 192, 200, 210, 211, 256–58, 349, 480n.)

40. The historical fate of the idea of linking knowing and 'making' is an extremely interesting, significant and complex one, which has not yet even been sketched comprehensively by anyone. (The best available account is a very incomplete and in some respects misleading one in Löwith 1968, pp. 19ff.) Some brief contributions to this outstanding problem follow. What would seem to be the first immediate response to Hobbes's 'genetic' account was Spinoza's treatment of definition in his *De intellectus emendatione*, §§95–

97 (and cf. §§71, 72) – Bruders paragraphing – on which, and other relevant matter, see McKeon 1930. Leibniz also gives a substantially similar treatment. (Relevant passages in his works are scattered. An excellent overview is given in Cassirer 1902, pp. 113ff.) It surfaces again in a central way in Kant's epistemology, first in his theory of mathematics, and second in his account of empirical knowledge. There can be little doubt, in the light of the well-known passage in the preface to the second edition of the *Critique of Pure Reason* (B xiii–xiv) especially, that he has a crucial affiliation with the Galilean experimental revolution. (See also *Critique of Judgement*, §75.) That it is in no way a Vichian idea – as was suggested by Jacobi 1816, pp. 352f whose remarks are an excellent example of the working of a 'pseudomorph (see the preceding note) – is shown decisively by one of his private notes: 'We do not really understand anything but what we can at the same time make, *if the materials for it were given to us*' (No. 395 of the *Reflexionen Kants zur kritischen Philosophie*, ed. B. Erdmann, Leipzig, 1882, my emphasis, WAS). But at a deeper level Kant of course introduces the central idea of a construction of objects as such (of the objects that are merely *reconstructed* in experiment) in terms of the 'transcendental subject'. Even though the latter still 'works on' a given material, the way had been opened to a fateful development. Through Jacobi and Fichte as historical-systematic intermediaries Hegel arrived at the program of submitting the element of givenness (objecthood as such) in knowledge to a 'final solution' with the idea of what exists being considered as the self-constitution of the Absolute Subject, the 'being', so to speak, of the latter being conceived as its own eternal 'becoming'. Thus he arrives at an intellectually 'iridescent' species of secularised version of Vico's – and the Christian – conception of the oneness of God's creating and knowing the world, though this time *via* a rich series of particular insights. After Hegel the connecting of knowing and making turns up in all sorts of places (e.g. in Nietzsche), but three particularly significant places may be mentioned: in Marxism (see especially Engels 1888, Pt II, especially p. 347), Dewey (see especially his great, at the present time mostly forgotten work 1938, on the general idea of which in relation to both Vico and Hobbes see Child 1953, and in a broader context Kannegiesser 1977), and Dingler (see the references and also the related historical survey in Klüver 1977, as well as the Dingler-inspired interpretation of Hobbes in Weiss 1983 and other writings referred to here). See also the superb Gehlen 1988. Finally, it may be noted that I have not so far mentioned the related 'production' theory of knowledge, stemming, approximately, from the work of Louis Althusser, on which see Suchting 1986, especially pp. 16ff.

41. For Vico genuine science deals with the eternal, the unchangeable, the indubitable and is thus identical with metaphysics (e.g. 1988, pp. 66, 67, 69, 77, 92) and indeed a thoroughly idealist metaphysics (1988, pp. 93f and 1963, pp. 138f). Of the epoch-making breakthroughs of early modern scientific work, he is opposed to analytic geometry (1988, pp. 59f; 1963, pp. 144f), his theoretical physics is completely backward-looking (physical forces are seated in metaphysical ones according to 1988, p. 59, motion is to be understood in terms of *conatus*, anchored in God, pp. 78f, and he is therefore opposed to the very idea of a principle of inertia, pp. 80ff). And as to experiment the partisan of the *verum = factum* principle writes the following in the review of his life (he refers to himself in the third person): 'A short time after this he learned of the growing prestige of experimental physics . . . but, profitable as he thought it for medicine and spagyric [alchemy – WAS], he desired to have nothing to do with this science. For it contributed nothing to the philosophy of man and had to be expounded in barbarous formulas, whereas his own principal concern was the study of Roman laws, the main foundations of which are the philosophy of human customs and the science of the Roman language and government, which can only be learned in the Latin writers.' Vico 1963, p. 128.

42. This is not, of course, to say that ordinary, everyday perception may not be pervasively understood in certain ways so customary that may be called, following Feyerabend 1975, p. 73, 'natural interpretations'. (An obvious example is the spontaneous geocentric view of the phenomena of 'sunrise' and 'sunset'.) But this does not entail that the perceived

situation itself is somehow subjectively 'constructed'. Such 'natural interpretations' can be made explicit and rejected, the perceived situation remaining the same. On the whole matter see also Husserl 1970a, esp. §9.

REFERENCES

Althusser, L.: 1969, *For Marx*, Allen Lane, The Penguin Press, London.

Althusser, L. and Balibar, E.: 1970, *Reading Capital* New Left Books, London.

Austin, J. L.: 1962, *Sense and Sensibilia*, Clarendon Press, Oxford.

Barnouw, J.: 1980, 'Vico and the Continuity of Science: The Relation of His Epistemology to Bacon and Hobbes', *Isis* **71**, 609–620.

Baruzzi, A.: 1973, *Mensch und Maschine. Das Denken sub specie machinae*, W. Fink, Munich.

Berlin, I.: 1976, *Vico and Herder. Two Essays in the History of Ideas*, Chatto & Windus, London.

Blumenberg, H.: 1987, *Das Lachen der Thakerin. Eine Urgeschichte der Theorie*, Suhrkamp, Frankfurt/M.

Böhme, G. (ed.): 1976, *Protophysik. Für und wider eine konstruktive Wissenschaftstheorie der Physik*, Suhrkamp, Frankfurt/M.

Böhme, G., van den Daele, W. and Krohn, W.: 1977, *Experimentelle Philosophie. Ursprünge autonomer Wissenschaftsentwicklung*, Suhrkamp, Frankfurt/M.

Butts, R. E. and Brown, J. (eds.): 1989, *Construction and Science. Essays in Recent German Philosophy*, Academic Publishers, Dordrecht/Boston/Lancaster.

Cassirer, E.: 1902, *Leibniz's System in seinen wissenschaftlichen Grundlagen*, N. G. Elwert, Marburg.

Cassirer, E.: 1922, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit* (third edition) 2 vols B. Cassirer, Berlin.

Cassirer, E.: 1923, *Substance and Function* in *Substance and Function and Einstein's Theory of Relativity* (1910/1921) Open Court Publishing Co., La Salle, Ill.

Cassirer, E.: 1959, *Philosophy of Symbolic Forms*, Volume 3: *Phenomenology of Knowledge* (1929) Yale University Press, Yale.

Cassirer, E.: 1985, 'Die Sprache und der Aufbau der Gegenstandswelt' (1932), in Orth, E. W. and Krois, J. M. (eds.), E. Cassirer, *Symbol, Technik, Sprache. Aufsätze aus den Jahren 1927–1933* F. Meiner, Hamburg.

Child, A.: 1953, 'Making and Knowing in Hobbes, Vico and Dewey', *University of California Publications in Philosophy* **16**, 271–310.

Collingwood, R. G.: 1939, *An Autobiography*, Clarendon Press, Oxford.

Dewey, J.: 1938, *Logic, the Theory of Inquiry*, Holt, Rinehart and Winston, New York.

Dingler, H.: 1928, *Das Experiment. Sein Wesen und seine Geschichte*, Ernst Reinhardt, Munich.

Dingler, H.: 1938, *Die Methode der Physik*, Ernst Reinhardt, Munich.

Dingler, H.: 1952, *Ueber die Geschichte und das Wesen des Experimentes* Eidos-Verlag, Munich.

Dingler, H.: 1969, *Die Ergreifung des Wirklichen Kapitel I–IV*, Suhrkamp, Frankfurt/M.

Dingler, H.: 1987, *Aufsätze zur Methodik*, Felix Meiner, Hamburg.

Engels, F.: 1970, *Ludwig Feuerbach and the End of Classical German Philosophy* (1888) in Karl Marx and Friedrich Engels, *Selected Works in Three Volumes* Volume 3, Progress Publishers, Moscow.

Feyerabend, P. K.: 1975, *Against Method. Outline of an Anarchistic Theory of Knowledge*, New Left Books, London.

Fritz, K. von: 1964, *Die ἐπαγωγή bei Aristoteles*, Verlag der Bayerischer Akademie der Wissenschaften, Munich.

Gaukroger, S.: 1986, 'Vico and the Maker's Knowledge Principle', *History of Philosophy Quarterly* **3**, 29–44.

Gehlen, A.: 1988, *Man. His Nature and Place in the World* (1972), Columbia University Press, New York.

Glasersfeld, E. von: 1989, 'Cognition, Construction of Knowledge, and Teaching', *Synthese* **80**, 121–140.

Hobbes, T.: 1839–45, *The English Works*, W. Molesworth (ed.), John Bohn, London.

Hobbes, T.: 1839–45a, *Opera philosophica, quae latine scripsit, omnia*, W. Molesworth (ed.), John Bohn, London.

Hobbes, T.: 1651, *Leviathan*, in Hobbes 1839–45, Vol. III.

Hobbes, T.: 1656, *Elements of Philosophy. The First Section, Concerning Body*, in Hobbes 1839–45, Vol. I.

Hobbes, T.: 1656a, *Six Lessons to the Savilian Professors of the Mathematics . . .*, in Hobbes 1839–45, Vol. VII.

Hobbes, T.: 1658, *Elementarum philosophiae sectio secunda, de Homine*, in Hobbes 1839–45a, Vol. II.

Hobbes, T.: 1660, *Examinatio et emendatio mathematicae hodiernae*, in Hobbes 1839–45a, Vol. IV.

Husserl, E.: 1970, *Logical Investigations*, Volume I (1913), Routledge and Kegan Paul, London.

Husserl, E.: 1970a, *The Crisis of the European Sciences and Transcendental Phenomenology. An Introduction to Phenomenological Philosophy* (1954) Northwestern University Press, Evanston.

Jacob, M. C.: 1988, *The Cultural Meaning of the Scientific Revolution*, Knopf, New York.

Jacobi, F.: 1816, 'Von den göttlichen Dingen und ihre Offenbarung' (1811), in *Werke*, Vol. III, G. Fleisher, Leipzig.

Kannegiesser, H. J.: 1977; *Knowledge and Society*, Macmillan, Melbourne.

Klüver, J.: 1977, *Operationalismus. Kritik und Geschichte einer Philosophie der exakten Wissenschaften*, Friedrich Frommann Verlag, Stuttgart-Bad Cannstatt.

Lefèvre, W.: 1978, *Naturtheorie und Produktionsweise. Probleme einer materialistischen Wissenschaftsgeschichtsschreibung. Eine Studie zur Genese der neuzeitlichen Naturwissenschaft*, Luchterhand, Darmstadt and Neuwied.

Lewin, K.: 1935, 'The Conflict between Aristotelian and Galilean Modes of Thought in Contemporary Psychology', in K. Lewin, *A Dynamic Theory of Personality*, McGraw-Hill, New York, pp. 1–42.

Löwith, K.: 1968, *Vicos Grundsatz:verum et factum convertuntur. Seine theologische Prämisse und deren säkulare Konsequenzen*, Carl Winter Universitätsverlag, Heidelberg.

Malcolm, N.: 1958, 'Knowledge of Other Minds', *Journal of Philosophy* **55**, 969–978.

Mead, G. H.: 1934, *Mind, Self and Society from the Standpoint of a Social Behaviourist*, University of Chicago Press, Chicago.

Mittelstrass, J.: 1970, *Neuzeit und Aufklärung:Studien zur Entstehung der neuzeitlichen Wissenschaft und Philosophie*, W. de Gruyter, Berlin and New York.

Mittelstrass, J.: 1972, 'The Galilean Revolution. The Historical Fate of a Methodological Insight', *Studies in History and Philosophy of Science* **2**, 297–328.

McKeon, R.: 1930, 'Causation and the Geometric Method in the Philosophy of Spinoza', *Philosophical Review* **39**, 178–189, 275–296.

Pears, D.: 1988, *The False Prison. A Study in the Development of Wittgenstein's Philosophy*, Volume 2, Clarendon Press, Oxford.

Raphael, M.: 1974, *Theorie des geistigen Schaffens auf marxistischer Grundlage*, S. Fischer, Frankfurt/M.

Russell, B.: 1956, 'Mathematics and the Metaphysicians' (1901/1918), in J. R. Newman (ed.), *The World of Mathematics*, Simon and Schuster, New York.

Sellars, W.: 1956, 'Empiricism and the Philosophy of Mind', in H. Feigl and M. Scriven (eds.) *Minnesota Studies in the Philosophy of Science*, Universiy of Minnesota Press, Minneapolis, Vol. I, pp. 253–329.

Spengler, O.: 1926–28, *The Decline of the West* (1923) 2 vols., Knopf, New York.

Stove, D.: 1991, *The Cult of Plato and Other Philosophical Follies*, Basil Blackwell, Oxford.

Suchting, W.: 1986, *Marx and Philosophy. Three Studies*, Macmillan, London.

Tetens, H.: 1987, *Experimentelle Erfahrung. Eine wissenschaftstheoretische Studie über die Rolle des Experiments in der Begriffs-und Theorie-Bildung der Physik*, Felix Meiner, Hamburg.

Vico, G.: 1988, *On the Most Ancient Wisdom of the Italians Unearthed from the Origins of the Latin Language* (1710), Cornell University Press, Ithaca and London (1744).

Vico, G.: 1961, *The New Science* (1744), Anchor Books, Garden City, New York.

Vico, G.: 1963, *Autobiography*, Great Seal Books, Ithaca.

Vygotsky, L. S.: 1962, *Thought and Language*, MIT Press, Cambridge, Mass.

Weiss, U.: 1983, 'Wissenschaft als menschliches Handeln. Zu Thomas Hobbes' anthropologischer Fundierung von Wissenschaft', *Zeitschrift für philosophische Forschung* **37**, 37–55.

Wertsch, J.: 1985, *Vygotsky and the Social Formation of Mind*, Harvard University Press, Cambridge, Mass.

Williams, R.: 1983, *Keywords. A Vocabulary of Culture and Society*, Fontana Paperbacks (Flamingo), London.

Wittgenstein, L. 1958, *Philosophical Investigations* (2nd ed.), Basil Blackwell, Oxford.

Zagorin, P.: 1984, 'Vico's Theory of Knowledge:A Critique', *Philosophical Quarterly* **34**. 15–30.