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GOING WRONG: TO MAKE A MISTAKE,  
TO FALL INTO AN ERROR

GIORA HON

*Contrariorum eadem est scientia.*

**H**ENRICH HERTZ, THE CELEBRATED German experimenter and theoretician, conducted in 1883 experiments on cathode rays. He concluded these pioneering experiments by stating that “the electrostatic and electromagnetic properties of the cathode rays are either nil or very feeble.”<sup>1</sup> This conclusion is believed today to be erroneous. According to current physical theories, cathode rays are streams of electrons: electrically charged particles.

It is ironic that the prototype of the oscilloscope—for that is what Hertz’s apparatus amounted to—should be instrumental in demonstrating that cathode rays have no closer relation to electricity than has light produced by an electric lamp. Indeed, Hertz argued that since “cathode rays are electrically indifferent, . . . the phenomenon most nearly allied to them is light.”<sup>2</sup>

Hertz’s error had originated in the false assumption that the intensity of the voltage across the condenser’s plates was high enough to induce a deflection of cathode rays when they were made to pass through the condenser. Hertz was not aware of the fact that, due to poor vacuum in the tube, the cathode rays ionized sufficient residual gas to permit neutralization of the plates; that in turn reduced substantially the intensity of the electric field produced by the condenser. Consequently, the expected deflection of the cathode rays could not be detected—an experimental result which led Hertz to an erroneous conclusion.<sup>3</sup>

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<sup>1</sup> Heinrich Hertz, *Miscellaneous Papers*, trans. D. E. Jones and G. A. Schott (London: Macmillan, 1896), 254.

<sup>2</sup> *Ibid.*

<sup>3</sup> For detailed studies see Giora Hon, “H. Hertz: ‘The Electrostatic and Electromagnetic Properties of the Cathode Rays are either Nil or Very Feeble’. (1883) A Case-Study of An Experimental Error,” *Studies in History*

Consider, for another instance, Franck and Hertz's erroneous interpretation of their experimental result. The Nobel Prize for physics was awarded in 1925 to James Franck and Gustav Hertz for their experimental work on the laws governing the impact of an electron upon an atom. The Nobel Committee claimed that Bohr's hypotheses of 1913 were no longer mere hypotheses but experimentally proved facts. The committee stated in the citation that the methods of verifying these hypotheses had been the work of Franck and Hertz.<sup>4</sup> Indeed, Franck and Hertz's experiment is the first experiment that demonstrated vividly in a graphic way the quantized spectrum of the atom's energy levels.

However, the original experimental work of Franck and Hertz was in error. To their credit, the laureates were better historians than their judges. "It appeared to me to be completely incomprehensible," observed Franck in his Nobel lecture, "that we had failed to recognize the fundamental significance of Bohr's theory, so much so, that we never even mentioned it once in the relevant paper."<sup>5</sup> Hertz, for his part, explicitly stated the error involved. He remarked that at the time they had "erroneously believed" an interpretation of their work that would have undermined the quantized atom, whereas, when rightly interpreted, "all the results so far attained with the electron-impact method agree very closely with Bohr's theory."<sup>6</sup>

Franck and Hertz regarded the first inelastic impact recorded by their device as an ionization process. They thus believed that the spectral line which they had detected was emitted as a result of the ionization of the mercury molecules. They were wrong in this interpretation. What they observed and measured was not what they thought they were observing and measuring. According to current physical theories, it is now believed that Franck and Hertz measured a real physical quantity: the first *excitation potential* of mercury.

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and *Philosophy of Science* 18 (1987): 367–82, and Jed Z. Buchwald, *The Creation of Scientific Effects: Heinrich Hertz and Electric Waves* (Chicago: The University of Chicago Press, 1994).

<sup>4</sup> *Nobel Lectures: Physics 1922–1941* (Amsterdam: Elsevier, 1965), 93, 96.

<sup>5</sup> James Franck, "Transformations of Kinetic Energy of Free Electrons into Excitation Energy of Atoms by Impacts," in *Nobel Lectures*, 106.

<sup>6</sup> Gustav Hertz, "The Results of the Electron-Impact Tests in the Light of Bohr's Theory of Atoms," in *Nobel Lectures*, 112, 119, 124, 128.

However, they thought it to be an *ionization potential* and therefore erred in their interpretation of the observational results.

Franck and Hertz's experiment constitutes a case where an error originated solely in the interpretation. It was neither the method nor the various physical approximations, but rather the theoretical considerations in comprehending the experimental result that gave rise to an error.<sup>7</sup>

Is there a difference between Heinrich Hertz's error and a miscalculation such as  $12 \times 12 = 136$ ? Is there a categorical difference between Franck and Hertz's error of interpretation and, say, a printer's error? My reply is positive. I shall present in this paper a distinction between two modes of going wrong. I shall attempt further to substantiate this distinction and show that the two ways of going wrong reveal different epistemological mechanisms.

"The problem of error is one of philosophy's very serious and crucial problems."<sup>8</sup> Alexander Koyré made this remark in a footnote. It epitomizes the state of the problem of error: the problem is "very serious and crucial," yet the treatments it has received have generally been scanty and peripheral, that is, metaphorically they amount to a footnote. Much difficulties still surround the problem of error. Typically, the problem is analyzed in terms of a certain philosophical system and no insight, independent of the system, is gained. Systematic philosophers invariably conceive of error in terms of the system they propound and thus the phenomenon of error loses its generality—it is made dependent on the system in which it is supposed to occur. Consider for example Descartes and Spinoza: they conceived of the notion of error with the very terms which their philosophical systems offered. In Descartes's system error is associated with the cleavage introduced between will and reason, whereas in Spinoza's doctrine error is associated with imagination. It is noteworthy that although Descartes and Spinoza propounded diametrically opposed philosophical systems, the definition of error which they employed is the same, namely, privation of knowledge. Error, however, has many

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<sup>7</sup> For a detailed study see Giora Hon, "Franck and Hertz versus Townsend: A Study of Two Types of Experimental Error," *Historical Studies in the Physical and Biological Sciences* 20 (1989): 79–106.

<sup>8</sup> Alexander Koyré, *Discovering Plato* (New York: Columbia University Press, 1945), 40 n. 9.

facets which the notion of privation cannot capture.<sup>9</sup> Moreover, one would not like to tie the analysis of error to a certain philosophical system. Rather, one would hope to obtain a general characterization of error which is not made dependent on a particular system of philosophy. With the present discussion I wish to enrich and broaden the study of error by suggesting a helpful distinction which does not rely on any philosophical system.

According to St. Augustine, one cannot go wrong except through ignorance.<sup>10</sup> Ignorance, however, can be either avoidable or unavoidable: one may misinterpret a text because one's knowledge of its language is faulty, but it can also be misinterpreted because certain circumstances about it were not known to its interpreter.<sup>11</sup> I seek to sustain here a distinction between two ways of going wrong which I call respectively *the way of mistake* and *the way of error*. I associate mistake with avoidable ignorance. A mistake can be avoided since checking procedures are known and available. By contrast, error is associated with unavoidable ignorance, when one applies techniques to novel phenomena, when one does not have the security of a well studied, agreed standard procedure—when one gropes, so to speak, in the dark. Metaphorically, a mistake occurs when one goes wrong on *terra firma*, but going astray in one's exploration of *terra incognita* amounts to an error.<sup>12</sup> Clearly, the use I make here of the words "mistake" and "error" is stipulative; this is not an exposition of the

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<sup>9</sup> See René Descartes, "Meditations," in *Philosophical Works*, trans. Elizabeth S. Haldane and G. R. T. Ross (Cambridge: Cambridge University Press, 1973), 1:177; Benedict de Spinoza, *Ethics*, ed. James Gutmann (New York: Hafner Press, 1974), 107. See also J. L. Evans, "Error and the Will," *Philosophy* 38 (1963): 136–48; Giora Hon, "On the Concept of Experimental Error" (Ph.D. diss., London University, 1985), chap. 1 and Giora Hon, "A Critical Note on J. S. Mill's Classification of Fallacies," *The British Journal for the Philosophy of Science* 42 (1991): 263–8.

<sup>10</sup> ". . . nec nisi rerum ignorantia possit errari." Sancti Augustini, *Enchiridion ad Laurentium, sive de fide, spe et charitate*, in *Opera Omnia* (Paris: Apud Gaume Fratres, Maurist edition, 1837), 6:352; St. Augustine, "Faith, Hope and Charity," trans. B. M. Peebles, in *The Fathers of the Church*, ed. R. J. Deferrari et al. (Washington, D. C.: The Catholic University of America Press, 1966) 2:381.

<sup>11</sup> See Arnaldo Momigliano, "Historicism Revisited," in *Essays in Ancient and Modern Historiography* (Oxford: Blackwell, 1975), 368.

<sup>12</sup> The Latin *erro* stands for "A. In general, to wander or stray about, to wander up and down, to rove . . . B. In particular, to miss the right way, to lose one's self, go astray." Hence the word "erratic." See C. T. Lewis and C. Short, *A Latin Dictionary* (Oxford: Clarendon Press, 1966), 657.

actual use of these words in English. Still, an attempt is made to adhere to the old idea: “by *mistake* you take the wrong one [whereas] in *error* you stray.”<sup>13</sup> It should be further pointed out that this distinction can be drawn in many other languages.

In view of the proposed distinction, miscalculations and printer’s errors are really mistakes, whereas Hertz’s experimental conclusion and Franck and Hertz’s interpretation are indeed errors. Arithmetical miscalculations and typographical errors can never be errors in the above proposed sense: they arise out of avoidable ignorance and there are available agreed procedures to rectify them, namely, following strictly the rules of arithmetics and executing careful proofreading with a standard dictionary, respectively. By contrast, it took some fifteen years until another experimenter could show that Hertz’s conclusion was in error and that the cathode rays do have electromagnetic properties—properties which are crucial for the functioning of the television and the computer screen.<sup>14</sup> And it took another theory—admittedly, an available theory, but a theory which was not then well established, namely Bohr’s theory—to show that Franck and Hertz erred in the interpretation of their meaningful experimental result.<sup>15</sup>

In order to maintain the distinction between the true and the false—a distinction which is essential for both mistake and error to be of any significance—there must be a certain criterion which allows one to uphold this difference. In other words, to use Dummett’s formulation, “for any statement which has a definite sense, there must be something in virtue of which either it or its negation is true.”<sup>16</sup> The fact that one can assign the truth-value “true” to a statement shows that there is something in virtue of which the statement is true. As Dummett further explains, the meaning of the claim that “there is something in virtue of which the statement is true”

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<sup>13</sup> J. L. Austin, “A Plea for Excuses,” in *Philosophical Papers*, 2d ed., ed. J. O. Urmson and G. J. Warnock (Oxford: Oxford University Press, 1979), 201–2.

<sup>14</sup> See Hon, “H. Hertz: ‘The Electrostatic and Electromagnetic Properties of the Cathode Rays.’”

<sup>15</sup> See Hon, “Franck and Hertz versus Townsend: A Study of Two Types of Experimental Error.”

<sup>16</sup> Michael Dummett, “Wittgenstein’s Philosophy of Mathematics,” in *Wittgenstein: The Philosophical Investigations*, ed. G. Pitcher (Macmillan, 1970), 433.

amounts to this: that “there is something such that if we knew of it we should regard it as a criterion (or at least as a ground) for asserting the statement.” It is the existence of such a criterion, such a ground, which allows one to assign either the truth-value “true” or “false” to a statement, that creates the condition for making mistakes, for falling into errors. It is the possible different characterizations of this criterion, or ground, which makes mistake and error distinguishable.

We observe here a two-tier system: a proposition which has been assigned the truth-value “true” and is found eventually to be “not-true,” reveals a criterion at a deeper level which has been misused. The various reasons for such misapplication, for such failure, are of no interest for us here, though they can be of great importance for other types of distinction.<sup>17</sup> What is of interest here is to observe how the realization of the processes involved in making a mistake or falling into an error can shed light on the way we acquire knowledge by bringing the concealed misused criterion into the fore, by throwing it into relief. We may shed light on the notion of beauty by studying its many opposites.<sup>18</sup> Similarly, we may shed light on knowledge by studying the nature of false propositions and the reasons for their occurrences. *Contrariorum eadem est scientia*—we never really know what a thing is unless we are also able to give a sufficient account of its opposite.<sup>19</sup>

The view that there exists something in virtue of which a statement may be assigned a truth-value represents in a nutshell the doctrine of realism.<sup>20</sup> I therefore call the criterion, or the ground, which allows for determining a statement either true or false, an element of reality. Notice, however, that no ontological commitment is required here; ontological questions simply do not arise vis-à-vis these elements: the concrete or abstract existence of these elements is of no

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<sup>17</sup> See, for example, Austin, “A Plea for Excuses,” where a distinction is drawn between justification and excuse.

<sup>18</sup> See Ruth Lorand, “Beauty and Its Opposites,” *The Journal of Aesthetics and Art Criticism* 52 (1994): 399–406.

<sup>19</sup> See John Stuart Mill, “On Fallacies,” in *A System of Logic* (London: Longmans, Green and Co., 1949), 481. See also Hon, “A Critical Note.” “As so often,” observed Austin, “the abnormal will throw light on the normal, will help us to penetrate the blinding veil of ease and obviousness that hides the mechanisms of the natural successful act”; Austin, “A Plea for Excuses,” 180. I try to do for knowledge what Austin does for action.

<sup>20</sup> See Dummett, “Wittgenstein’s Philosophy of Mathematics,” 433.

importance for the proposed distinction. They are referred to as elements of reality since in this two-tier system they constitute the criterion, the ground—the first level—for asserting a certain proposition on the second level.

Following up the distinction between mistake and error, we observe that in the case of mistake elements of reality amount to rules, be they regulative or constitutive.<sup>21</sup> The existence of a rule—in particular, a rule of computation or a rule which governs the use of a symbol or a word—rests ultimately upon the fact that there is an agreement in practice over its application.<sup>22</sup> A rule may be misapplied for a variety of reasons, but as I have remarked, these reasons, whatever they may be, are of no importance for the present analysis. The crucial feature is rather the fact that, in so far as we can agree in assigning the truth-value “true” to a proposition which is governed by a rule, we can detect a misapplication, that is, a mistake, in every procedure which does not, under the same circumstances, produce the same proposition. Arithmetical miscalculations and incorrect spellings constitute straightforward examples.

This is not the case with error. No immediate and rigorous agreed methods of detection, let alone of correction, are available for error; such methods may be even unknown. Indeed, it is precisely because one is lacking knowledge of those elements of reality which could have allowed one to render a statement erroneous, that error is epistemologically more interesting than mistake. The search for these unknown elements of reality has the potential of revealing new knowledge. By contrast, the detection of a mistake—the misapplication of a certain rule—does not necessarily point to a new knowledge; typically, it throws light on the psychological make-up of the individual who made the mistake.<sup>23</sup>

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<sup>21</sup> John R. Searle, *Speech Acts* (Cambridge: Cambridge University Press, 1969), 33–42.

<sup>22</sup> Michael Dummett, “Wittgenstein on Mathematics,” *Encounter* 50 (1978): 65.

<sup>23</sup> In his insightful study of mistakes and slips, Freud transformed these phenomena into a psychoanalytical tool of great power. He did not however draw a distinction between mistake and error. See Sigmund Freud, “Parapraxes,” in *The Complete Psychological Works of Sigmund Freud*, trans. James Strachey (London: Hogarth Press, 1971), 15:15–79. For further studies of the psychology of error, see James Reason, *Human Error* (Cambridge: Cambridge University Press, 1990), especially chapter 2 and its rich bibliography.

An error of interpretation may serve as an example. An erroneous interpretation of experimental data might withstand all kinds of criticism and reexamination, but only in the light of some other results—theoretical or experimental—could it be shown that the interpretation is in error, the relevant elements of reality being apprehended. This is the case of Franck and Hertz's experiment. Once it was understood that Bohr's theory—conceived in 1913 and still not well established by 1914 when the experiment was carried out—could throw a revealing light on the result of this experiment, the theory as well as the experiment received adequate recognition and eventually the Nobel Prize.

In sum, there exist, on the operative level, publicly agreed, standard procedures by which a mistake can be always, in principle, identified and rectified. By contrast, the procedures for detecting and countering an error are left entirely to the ingenuity of the individual critic. We are therefore culpable when we make a mistake, though we can come up with justifications and excuses.<sup>24</sup> In the case of a mistake, ignorance could have been in principle avoided and we may be blamed for not applying the known agreed rule correctly. But it may be that ignorance could not have been avoided; it is in such cases that we fall into error.

It might seem that the usefulness of this distinction is not clear. What are we to profit from such a distinction? Let us examine then a philosophical position which does not maintain this distinction. Such a position can be found in Wittgenstein's *On Certainty*. The following quotation is a good example of an argument which does not maintain a distinction between mistake and error. It is worth while to quote at length the original text in German and its English translation:

Das heißt doch: die Möglichkeit eines *Irrtums* läßt sich in gewissen (und häufigen) Fällen eliminieren.—So eliminiert man (ja auch) *Rechnungsfehler*. Denn wenn eine Rechnung unzählige Male nachgerechnet worden ist, so kann man nun nicht sagen: "Ihre Richtigkeit ist dennoch nur *sehr wahrscheinlich*,—da sich immer noch ein *Fehler* eingeschlichen haben kann." Denn angenommen es schiene nun einmal, daß ein *Fehler* entdeckt worden sei—warum sollen wir nicht *hier* einen *Fehler* vermuten?

This surely means: the possibility of a *mistake* can be eliminated in certain (numerous) cases.—And one does eliminate *mistakes* in calcu-

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<sup>24</sup> See Austin, "A Plea for Excuses."

lation in this way. For when a calculation has been checked over and over again one cannot then say “Its rightness is still only *very probable*—for an *error* may always still have slipped in”. For suppose it did seem for once as if an *error* had been discovered—why shouldn’t we suspect an *error here*?<sup>25</sup>

What concerns us is not so much the argument itself, but rather the fact that Wittgenstein uses here the terms “*Irrtum*” and “*Fehler*” interchangeably. Notice that the translators followed Wittgenstein closely and did not introduce the distinction: they use, like Wittgenstein, the terms “mistake” and “error” interchangeably. This illustration is indicative of the whole book.

We have here then an interesting case: Wittgenstein, who is well known for his refined distinctions, does not show any interest in clearing the confusion that surrounds the phenomenon of error. Although his objective is to delineate the differences between types of proposition from the perspective of their claim to certainty, he does not seek a distinction of different types of error.

Wittgenstein’s last notes have been compiled to form the book *On Certainty*. In these notes the claim to realism relies on the inherited background. “I did not get my picture of the world by satisfying myself of its correctness,” states Wittgenstein, “nor do I have it because I am satisfied of its correctness. No: it is the inherited background against which I distinguish between true and false.”<sup>26</sup> Similarly, when he argues against considering an experimental result a proof,<sup>27</sup> he explains that the expression “‘we are quite sure of it’ does not mean just that every single person is certain of it, but that we belong to a community which is bound together by science and education.”<sup>28</sup> Hence his remarks on authority: “So is this it: I must recognize certain authorities in order to make judgements at all?”<sup>29</sup> The comparison with Descartes is therefore instructive: “Descartes believes that a single human being can, all by himself, arrive at many certainties. Wittgenstein’s view is that anyone’s certainty about

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<sup>25</sup> Ludwig Wittgenstein, *On Certainty*, ed. G. E. M. Anscombe and G. H. von Wright, trans. Denis Paul and G. E. M. Anscombe (Oxford: Blackwell, 1977), §650. Emphases are in the original except for “*Fehler*” and “*error*.”

<sup>26</sup> *On Certainty*, §94.

<sup>27</sup> *Ibid.*, §§272–7.

<sup>28</sup> *Ibid.*, §298.

<sup>29</sup> *Ibid.*, §493. See also §161.

anything presupposes a mass of knowledge and belief that is inherited from other human beings and taken on trust.”<sup>30</sup>

In *On Certainty* Wittgenstein studies, inter alia, the nature of different kinds of proposition from the point of view of their failure to attain certainty.<sup>31</sup> In Malcolm’s apt description, Wittgenstein explores the concept of certainty “by putting it under stress—as one might test the rigidity of a metal in a laboratory.”<sup>32</sup> However, it should be remarked that the arguments which Wittgenstein brings to bear on the issue of certainty are spread throughout the book. As he intimates candidly: “I do philosophy now like an old woman who is always mislaying something and having to look for it again: now her spectacles, now her keys.”<sup>33</sup> An attempt has been made here to glean the relevant arguments and to set them in order. The reader should note further that since Wittgenstein does not make any distinction between error and mistake, the terms are used *interchangeably*. I shall however conclude the analysis by reintroducing the proposed distinction.

A proposition can be said to be certain only if it is inconceivable that one should be wrong in thinking it true.<sup>34</sup> What is then the nature of the claim: “I can’t be making a mistake about that?” What if it does turn out to be wrong? Furthermore, how does the distinction between mistake and error illumine this failure?

Examining the claim to certainty, Wittgenstein remarks that “with the word ‘certain’ we express complete conviction, the total absence of doubt, and thereby we seek to convince other people.”<sup>35</sup> However, this is only *subjective* certainty. Wittgenstein therefore presses on to ask “when is something objectively certain?” That kind of certainty may be attained when a mistake is entirely impossible. (“Wenn ein Irrtum nicht möglich ist.”) The claim that one cannot be making a mistake about a certain proposition is commonly used; “but we may question,” Wittgenstein writes, “whether it is then to be taken

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<sup>30</sup> Norman Malcolm, *Nothing is Hidden* (Oxford: Blackwell, 1986), 235.

<sup>31</sup> See also *ibid.*, 201.

<sup>32</sup> *Ibid.*, 219.

<sup>33</sup> *On Certainty*, §532.

<sup>34</sup> See A. J. Ayer, “Wittgenstein on Certainty,” in *Understanding Wittgenstein*, ed. G. Vesey, vol. 7 of *The Royal Institute of Philosophy Lectures* (New York: Macmillan, 1974), 232.

<sup>35</sup> *On Certainty*, §194.

in a perfectly rigorous sense, or is rather a kind of exaggeration which perhaps is used only with a view to persuasion.”<sup>36</sup>

The question as to what is precisely the nature of the claim that one cannot be making a mistake about a certain proposition is an aspect of the principal issue of assigning the truth-value “true” or “false” to a proposition. Here Wittgenstein sees the core of the problem, for in his view the expression “true or false” has something misleading about it.

It is like saying “it tallies with the facts or it doesn’t”, and the very thing that is in question is what “tallying” is here. Really “the proposition is either true or false” only means that it must be possible to decide for or against it. But this does not say what the ground for such a decision is like.<sup>37</sup>

Clearly, Wittgenstein does not differentiate between different types of criterion, or ground, which allow one “to decide for or against” a certain proposition. According to Wittgenstein, a proposition which is either true or false must have a criterion for making this decision, but this demand “does not say what the ground . . . is like.” This is the very juncture where I beg to differ. I claim that when a proposition has the truth-value “true” or “false,” it is then possible to know the criterion, or at least its nature, that is, whether the criterion is a rule or not.

The problem is further compounded by the fact that the ground has to be established objectively so that *objective* certainty will be attained.<sup>38</sup> In Wittgenstein’s words,

it needs to be *shewn* [sic] that no mistake was possible. Giving the assurance “I know” does not suffice. For it is after all only an assurance that I can’t be making a mistake, and it needs to be *objectively* established that I am not making a mistake about *that*. . . . “I know that” means “I am incapable of being wrong about that”. But whether I am so must admit of being established objectively.<sup>39</sup>

<sup>36</sup> See also *On Certainty*, §669.

<sup>37</sup> *Ibid.*, §§199–200.

<sup>38</sup> See also Malcolm, *Nothing is Hidden*, 206–11.

<sup>39</sup> *On Certainty*, §§15–16. “I know that p” is in place only where I can give grounds for p that are surer than p; in practice, this is generally not the case (§243). This is part of Wittgenstein’s criticism of Moore’s proof of the external world. See also Malcolm, *Nothing is Hidden*, 213–14, 216, 221–32 and Anthony Kenny, *Wittgenstein*, (London: Penguin, 1976). Kolakowski remarks that “the predicates ‘true’ and ‘false’ are not found in experience . . . They belong to the human interpretation of experience”; Leszek Kolakowski, *Husserl and the Search for Certitude* (New Haven: Yale University Press, 1975), 15–16.

One can of course make the claim: “I can’t be making a mistake about that.” But what if it does turn out to be wrong?<sup>40</sup> Some day one may realize that one was not competent to judge.<sup>41</sup> To illustrate this difficulty, Wittgenstein examines a proposition from day-to-day physics:

We say we know that water boils and does not freeze under such-and-such circumstances. Is it conceivable that we are wrong? Wouldn’t a mistake topple all judgement with it? More: what could stand if that were to fall? Might someone discover something that made us say “It was a mistake”? Whatever may happen in the future, however water may behave in the future,—we *know* that up to now it has behaved *thus* in innumerable instances.<sup>42</sup>

The emphases, *know . . . thus*, are Wittgenstein’s; they are there to stress that knowing is supposed to give in this context only an assurance that this is the way nature behaves, or so at least it has behaved in many passed instances. Notwithstanding, one cannot exclude objectively and a priori the possibility of error.

Consider, for another example, the case of Wittgenstein himself. He knows that “no one has ever been on the moon; the moon is along way off and it is impossible to climb up there or fly there.”<sup>43</sup> In his view, it is a joke to suggest that somebody was on the moon. Wittgenstein did not live to see that he had been wrong. Was he incompetent to judge? The purpose of the phrase “I know,” or rather “we know,” appears to indicate an assurance, a reliance, which in Wittgenstein’s view must emerge from shared experience.<sup>44</sup> But, then, are we not trapped in a circular argument?<sup>45</sup>

Wittgenstein seems to hint here at the impossibility—at least with regard to a large class of empirical propositions—of establishing *objectively* that one cannot go wrong. Although he regards the claims which these propositions make as knowledge, he nevertheless implies that this knowledge is temporal.<sup>46</sup> By making an experiment

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<sup>40</sup> *On Certainty*, §641.

<sup>41</sup> *Ibid.*, §645.

<sup>42</sup> *Ibid.*, §558.

<sup>43</sup> *Ibid.*, §106.

<sup>44</sup> *Ibid.*, §575.

<sup>45</sup> See also Malcolm, *Nothing is Hidden*, 211–14.

<sup>46</sup> I use the term “temporal” so that it will stand in contrast to the claims of propositions of grammar which Wittgenstein characterizes as “not temporal”; see *On Certainty*, §57.

a few times, one discovers that under *such* circumstances *this* happens. In the final analysis, one relies upon such an experience or its report, and this trust has so far proved itself.<sup>47</sup> In other words, as Malcolm puts it, “objective certainty is a human attitude.”<sup>48</sup>

One sees then that the presence of the possibility of doubt and indeed of error and mistake does not undermine the possibility of knowledge. On the contrary, knowledge can arise only when there is a possibility of being wrong.<sup>49</sup> This view echoes Aristotle’s complementary approach to the concepts of knowledge and error. For Aristotle it is a principle that “error as well as knowledge in respect to contraries is one and the same.”<sup>50</sup>

Notwithstanding, there still seem to be types of proposition which can be rendered certain on objective grounds, namely, a priori propositions of logic and mathematics. Yet the problem of being wrong persists even here; evidently, it is possible to make mistakes in logic and mathematics, and one cannot always be sure of the conclusions to which logical and mathematical propositions appear to lead.

Here, again, we see the usefulness of the distinction between mistake and error, for in logic and mathematics one typically makes mistakes and not errors in the sense which I propose. To be sure, it is a moot question whether, by their very nature, logic and mathematics are closed systems. Yet, it is commonly held that the criterion which determines in these systems whether a proposition is “true” or “false” is a rule. Following the proposed distinction, we would normally characterize a false proposition in closed systems as a mistake. Thus the question as to whether or not there are errors in logic and mathematics forces immediately the underlying assumed metaphysics to come to the fore. A further interesting question to pose in this connection is whether a computer can make a mistake or fall into an error. The answer to this question brings immediately to light one’s view of the epistemological status of the computations which a computer can execute.

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<sup>47</sup> *On Certainty*, §603.

<sup>48</sup> See Malcolm, *Nothing is Hidden*, 219; see also 216.

<sup>49</sup> C. Coepe, “Wittgenstein’s Theory of Knowledge,” in *Understanding Wittgenstein*, 258.

<sup>50</sup> Aristotle, “De anima” 427b5, trans. J. A. Smith, in *The Works of Aristotle*, vol. 3, ed. D. Ross (Oxford: Clarendon Press, 1963).

In his study of the nature of proposition, Wittgenstein returns again and again to the question as to what is precisely the difference between a mathematical and an empirical proposition; that is, the difference, for example, between a proposition which states the result of a calculation and one which conveys an experimental result. Dummett sets the scene for this problem in a clear fashion:

A mathematical proof, of which computations are a special case, is a proof in virtue of our using it to serve a certain purpose; namely, we put the conclusion or result in the archives, that is, treat it as unassailable and use it as a standard whereby to judge other results. Now something cannot serve this purpose, and hence is not a mathematical proof, unless we are able to exclude the possibility of a mistake's having occurred in it. We must be able to "take in" a proof, and this means that we must be certain of being able to produce the *same* proof. We cannot in general *guarantee* that we shall be able to repeat an experiment and get the same result as before. Admittedly, if we get a different result, we shall look for a relevant difference in the conditions of the experiment; but we did not have in advance a clear conception of just what was to count as a relevant difference.<sup>51</sup>

Dummett omits the possible statistical spread of an experimental result, but he is amply clear about the possibility, indeed the requirement, of eliminating all the mistakes which may occur in a mathematical proof: "Mustn't mistakes be *logically* excluded?" to use Wittgenstein's words.<sup>52</sup> But then, Wittgenstein asks, "can it be seen from a rule what circumstances logically exclude a mistake in the employment of rules of calculation? What use is a rule to us here? Mightn't we (in turn) go wrong in applying it?"<sup>53</sup> Wittgenstein deliberates on this issue but does not arrive at a definite conclusion. He thinks that, on the one hand, one "cannot be making a mistake about  $12 \times 12 = 144$ ;" but, on the other hand, a mathematical proposition has been obtained by a series of actions which, as he observes, "are in no way different from the actions of the rest of our lives, and are in the same degree liable to forgetfulness, oversight and illusion."<sup>54</sup> Wittgenstein therefore claims that "if the proposition  $12 \times 12 = 144$

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<sup>51</sup> Dummett, "Wittgenstein's Philosophy of Mathematics," 440 (emphases in the original).

<sup>52</sup> *On Certainty*, §194.

<sup>53</sup> *Ibid.*, §26.

<sup>54</sup> *Ibid.*, §651. "The question 'But mightn't you be in the grip of a delusion now and perhaps later find this out?'—might also be raised as an objection to any proposition of the multiplication tables"; *ibid.*, §658.

is exempt from doubt, then so too must non-mathematical propositions be.”<sup>55</sup>

Moreover, in his view, “the same proposition may get treated at one time as something to test by experience, at another as a rule of testing.”<sup>56</sup> This claim is not surprising since in the two-tier system the role of each of the two levels may reverse: the criterion may turn out to be the proposition being tested and, conversely, the proposition to be tested may be considered the ground for asserting the “criterion.”<sup>57</sup> A good example is the exponential law of errors: “everybody believes in the exponential law of errors: the experimenters, because they think it can be proved by mathematics; and the mathematicians, because they believe it has been established by observation.”<sup>58</sup> This possibility of reversing, or rather inverting, the role of each of the two levels demonstrates that no ontological commitment has been made. Wittgenstein makes the proposition depend on the context of its use, notwithstanding his awareness of the “official” stamp of incontestability which mathematical propositions have been given.<sup>59</sup> It is only with respect to logic that Wittgenstein feels sufficiently confident to state that it would be wrong to claim that logic too can be an empirical science.<sup>60</sup>

Wittgenstein’s analysis has led him to put empirical propositions such as “This is my hand” on a par with propositions of arithmetic.

I want to say: If one doesn’t marvel at the fact that the propositions of arithmetic (e.g. the multiplication tables) are “absolutely certain”, then why should one be astonished that the proposition “This is my hand” is so equally?<sup>61</sup>

The multiplication tables have the character of a rule; they cannot be doubted, as Wittgenstein explains, without giving up all judgment.<sup>62</sup> However, he equally realizes that no doubt can exist about certain empirical propositions if making judgments is to be possible at all.

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<sup>55</sup> *On Certainty*, §653.

<sup>56</sup> *Ibid.*, §98.

<sup>57</sup> See *ibid.*, §163 and §321.

<sup>58</sup> Giora Hon, “Towards a Typology of Experimental Errors: An Epistemological View,” *Studies in History and Philosophy of Science* 20 (1989): 476.

<sup>59</sup> *On Certainty*, §655.

<sup>60</sup> *Ibid.*, §98.

<sup>61</sup> *Ibid.*, §448. See also §657.

<sup>62</sup> See, for example, *ibid.*, §494.

“I am inclined to believe,” he writes, “that not everything that has the form of an empirical proposition *is* one.”<sup>63</sup> He admits that “one may be wrong even about ‘there being a hand here’. Only in particular circumstances is it impossible”; but then, as he remarks, “even in a calculation one can be wrong—only in certain circumstances one can’t.”<sup>64</sup>

In *On Certainty* Wittgenstein arrives at the conclusion that there is no sharp boundary either between the a priori propositions of logic, mathematics, and—one may add—grammar, and *some* propositions that would ordinarily be counted as empirical; or between these propositions and those of which the empirical character is not at all in question.<sup>65</sup> Having blurred the sharp line of demarcation which is commonly held between a priori propositions of logic and mathematics, and those which contain empirical content, Wittgenstein asks rhetorically: “Is it that rule and empirical proposition merge into one another?”<sup>66</sup> Indeed, he maintains that it is due to the fuzzy boundary between rule and empirical proposition that the demarcation between the different types of proposition is not sharp.

But wouldn’t one have to say then, that there is no sharp boundary between propositions of logic and empirical propositions? The lack of sharpness is that of the boundary between *rule* and empirical proposition.<sup>67</sup>

Notwithstanding this conclusion, I claim that there is still the possibility of distinguishing sharply between propositions on the basis of the ways in which they turn out wrong; that is, clear distinctions can be drawn between different modes of being wrong which reflect in turn the different characters of proposition. Wittgenstein himself acknowledges that “not all corrections of our views are on the same level”;<sup>68</sup> indeed, he writes that he distinguished between different kinds of mistake.<sup>69</sup> Moreover, he enquires,

mustn’t one make a distinction between the ways in which something “turns out wrong”?—How *can* it be *shewn* [sic] that my statement was

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<sup>63</sup> *On Certainty*, §308.

<sup>64</sup> *Ibid.*, §25; see also §217.

<sup>65</sup> See Ayer, “Wittgenstein on Certainty,” 234.

<sup>66</sup> *On Certainty*, §309.

<sup>67</sup> *Ibid.*, §319.

<sup>68</sup> *Ibid.*, §300.

<sup>69</sup> *Ibid.*, §659.

wrong? Here evidence is facing evidence, and it must be *decided* which is to give way.<sup>70</sup>

However, he does not seem to have carried this program through. Although Wittgenstein suggests that distinctions between the ways in which something “turns out wrong” should be made, he does not differentiate between mistake and error (*Fehler* and *Irrtum*, respectively) as two different modes of being wrong. He uses rather, as I have observed, the two terms interchangeably. The closest he gets to this distinction is to separate mistake from mental disturbance, however transient the latter may be.<sup>71</sup> “Can we say,” he asks rhetorically, that “a *mistake* doesn’t only have a cause, it also has a ground?” In other words, as he explains, “when someone makes a mistake, this *can* be fitted into what he knows aright.”<sup>72</sup> One wonders what happens when one falls into an error.

This characterization of mistake matches well with my proposal to distinguish between mistake and error. It is not the case that error has no ground; it is rather that the ground in this case is not known. Thus, when one falls into an error, it *cannot* be fitted into what one knows aright; one thinks one knows but this, alas, is not the case. In the case of error the relevant criterion—the element of reality, to recall my terminology—is simply not known (hence the standard definition of error as privation of knowledge). By contrast, in the case of mental disturbance a ground does not exist at all, whereas a mistake, for which “a place is prepared in the game,” subsists on the existence of a rule that could and should be known aright.<sup>73</sup> Thus, when one makes a mistake, one “must already judge in conformity with mankind.”<sup>74</sup>

I submit then that the distinction between mistake and error can reconstitute a clear demarcation line between propositions whose truth-values depend on rules and their applications, and those which involve in the assignment of their truth-values elements of reality other than rules, that is, elements whose claim to knowledge is incomplete, for example, sense data.

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<sup>70</sup> *On Certainty*, §641.

<sup>71</sup> See *ibid.*, §71.

<sup>72</sup> *On Certainty*, §74 (my emphasis); see also §647. On the distinction between mistake and mental disturbance see Kenny, *Wittgenstein*, 207–11.

<sup>73</sup> *On Certainty*, §647.

<sup>74</sup> *Ibid.*, §156. See also Malcolm, *Nothing is Hidden*, 215.

The intricate attempt to distinguish between different types of proposition from the perspective of their claims to certainty seems to have motivated Wittgenstein to underline what I take to be two major aspects of the problem of error in its general sense. The first aspect concerns the difficulty of establishing *objectively* that one is not wrong. The second focuses on the distinction between the different ways in which something “turns out wrong.” I have elaborated elsewhere the different ways in which an experiment may turn out wrong.<sup>75</sup> The distinction between mistake and error addresses this second issue from a more general perspective. It is an attempt to contribute to a wider program, namely, the epistemology of error, which the literature appears to be lacking.<sup>76</sup>

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<sup>75</sup> Hon, “Typology of Experimental Errors.”

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