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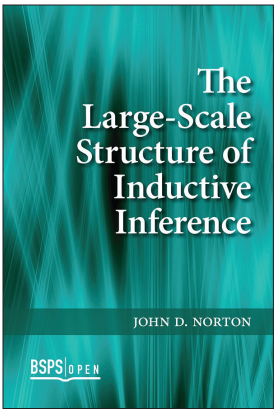

THE LARGE-SCALE STRUCTURE OF INDUCTIVE INFERENCE

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Dowsing: The Instabilities of Evidential Competition

1. Introduction

In Chapter 4, "The Uniqueness of Domain-Specific Inductive Logics," I addressed the possibility that a single collection of empirical facts might evidentially support multiple sciences equally well. This circumstance would negate the power of evidence to determine a definite theory and compromise the uniqueness of our mature sciences. Worse, since these facts also determine the applicable inductive logic, we would then have multiple logics applicable in the same domain. Inductive anarchy would prevail.

In that earlier chapter, I argued that this possibility has not arisen in the case of mature sciences, well supported by an extensive body of empirical evidence. There is, for example, only one periodic table of the elements and only one chemistry derived from it. I also argued that the material theory of induction provides a mechanism that precludes the persistence of equal support for such multiple sciences. It is based on an instability in the competition among rival theories. Insofar as the differences between competing theories manifest in empirically decidable disagreements, evidence can point in favor of one over the other.[1] One theory then secures more facts than its rival. Since background facts so secured can then authorize more inductive inferences, that gain enhances its inductive reach while weakening that of its rival. The enhanced theory is then better placed to achieve more successes at

1 If the differences between them have no empirical manifestation, then we must ask whether the differences matter. Are they the same theories empirically but dressed up in different theoretical clothing? Do they contain elements superfluous to their empirical content?

the expense of its rival. A continuation of the process leads to the evidential dominance of one theory.

Where might we look to see this process within real sciences? The natural place is among the many fields of endeavor labeled as pseudosciences: astrology, parapsychology, telepathy, telekinesis, crystal healing, psychic surgery, and many more. These endeavors purport to offer bodies of knowledge in competition with established science. Each proposes facts radically at variance with standard science. If they are correct, then these facts would induce an inductive logic different from that of standard science.[2]

These endeavors are routinely disparaged by established science. The term "pseudoscience" is not intended to be flattering. In my view, these pseudosciences are properly disparaged, for the case has been made abundantly that they lack proper evidential support. The tradition of challenging the evidential credentials of these endeavors is as old as these endeavors themselves. Recently, a leading role among many in these efforts has been taken by CSICOP (Committee for the Scientific Investigation of Paranormal Claims). It was founded in 1976 and later renamed as CSI (Committee for Skeptical Inquiry). Its major vehicle of publication is the magazine *Skeptical Inquirer*, whose pages have offered evidential scrutiny of extraordinary claims since the magazine's inception in 1976 as *The Zetetic*.

My goal in this chapter is not once again to make the evidential case against these many pseudosciences. Rather, it is to see whether their evidential collapses resulted from the mechanism sketched earlier. It would be impractical and redundant to trace the collapse in many of these sciences. One will suffice as an illustration. The practice of dowsing is well suited to this analysis. The practice itself is narrowly defined: a dowser walks over a candidate area of land seeking underground water sources or, in the original tradition, metallic ores. The dowser employs some instrument as a detector. A forked hazel twig is traditionally preferred. The detection event is unambiguous: the detector moves, clearly and sometimes even violently, in response to the water or metal ores sought. Finally, success or failure

2 Another example of a variant logic is among conspiracy theorists. Many proceed under the assumption that nefarious hidden powers are systematically misleading the public for their own ends. The presumption of this fact leads the conspiracy theorists to an inverted inductive principle: strong evidence against their theory is actually evidence of the perfection of the deception by the hidden powers. Evidence "against" is really evidence "for."

is unambiguously determinable. Either there is water present there or not or the metal ore sought is there or not. There has been a long-standing debate over the effectiveness of dowsing. Its proponents are zealous in offering extraordinary tales of unlikely successes. Its critics are equally zealous in denouncing the practice as superstitious hokum.

The literature on dowsing is so massive that I make no effort to do it justice here. My goal is solely to investigate the competition between proponents and skeptics and to show that an instability in the competition leads to the collapse of the scientific credibility of dowsing and the evidential dominance of its scientific skeptics.

In Section 2, I briefly sketch the emergence of dowsing in the historical literature. In Sections 3 to 6, I recount the factual disputes surrounding dowsing: which physical theory if any governs the process (Section 3), how water sought by dowsers is distributed geologically (Section 4), whether there really is any effect in the first place (Section 5), and finally whether the effect can be merely unconscious self-deception (Section 6). In Section 7, I review how proponents and skeptics end up presuming different inductive logics because they differ in their presumptions of the prevailing facts. In Section 8, I conclude by displaying the instability that leads to the evidential dominance of the skeptics.

We shall see that the competition unfolded on two levels: that of theory and that of phenomena. At the level of theory, in the sixteenth century, proponents and skeptics had positions of comparable strength. The physical interaction between metallic ores and the dowser's rod fit well enough with the qualitative understanding of electric and magnetic effects. With continuing investigations in each field, theories of electricity and magnetism developed by the end of the nineteenth century into a quantitatively precise candidate theory of everything. This dominant theory supported the inference that there is no physical effect in nature corresponding to dowsing. The proponents of dowsing had nothing to match. They were reduced to speculating that the effect derived from some sort of qualitatively described psychic process.

At the level of phenomena, proponents and skeptics were once again in comparable positions in the sixteenth century. Proponents could point to a well-established and apparently successful practice of dowsing. Skeptics could point to the uncomfortable fact that dowsing did not work for everyone. The discovery of the ideo-motor principle in the nineteenth century allowed skeptics to block the inference from the motion of the dowser's rod to a

real process of detection. The motion was the result of unconscious muscular actions by the dowser. The proponents could offer no comparable account of why dowsing failed for some. Proponents could infer from the success of the later tradition of water dowsing to the reality of a real process of water detection. The inference was warranted by the assumption that underground water was sparsely distributed and otherwise hard to locate. The inference lost its warrant with the recognition that underground water tables are widely dispersed and hard to miss in a random drilling. The failure of dowsers to detect their targets was established in the twentieth century for all but the most ardent believers by statistical analysis of well-crafted tests.

Finally, the successes of skeptics at the theoretical and phenomenological levels were mutually reinforcing. The theory deployed by skeptics left no niche for dowsers' physical processes of detection. Using this as a warranting fact, skeptics could infer from the failure of dowsers in tests to the conclusion that any apparent dowsing successes in the phenomena must be spurious. Conversely, the failure of dowsers in these tests supported the conclusion that skeptical theorists had not somehow overlooked a theoretical process that could underpin dowsing.

2. The Phenomenon Established

The modern tradition in dowsing seems to have started among the miners in Saxony and the Hartz mountains in what is now modern-day Germany. It was well established by the sixteenth century. From there, it spread over Europe and beyond. The process presumed to create the detection was direct physical interaction between underground metallic ores and the dowser's instrument. Since the interaction, apparently, was manifested routinely, it was reasonable to expect some general theoretical basis for it. That such an interaction was possible lay well within the contemporary state of physical theorizing. Barrett (1911, 169) suggested that a then common belief was that certain trees are attracted by metallic ores and droop over them. Agricola ([1556] 1912, 39), who gave the first extended account of dowsing, reported the belief; proponents of dowsing asserted "that movement of the twig is caused by the power of the veins and sometime[s] this is so great that branches of trees growing near a vein are deflected toward it." It was then only a small step to detach a twig from the tree and use its attraction to the metallic ores as a means of detection.

Such an attraction seems to be little different from the attractions then known in electrostatic phenomena and magnetism. Agricola ([1556] 1912, 39) likened the action to that of a magnet attracting iron. Proponents of dowsing, he reported, explained the failure of some people to succeed at dowsing through "some peculiarity of the individual, which hinders and impedes the power of the veins." His report revealed the rudimentary nature of the relevant science, for he likened this explanation to the supposed power of garlic to weaken a magnet: "For a magnet smeared with garlic juice cannot attract iron . . ." (39). Garlic has no such power, of course, and that is a fact easily recovered by a simple test.[3]

3. Disputes over the Theory of Dowsing Processes

At its inception, the effect of metallic ores on the dowser's twig was *likened* to the effects of electrical and magnetic attraction. It was rudimentary to see that the dowsing effect was not mediated by then known magnetic and electrical actions. Most ores sought by dowsing were not magnetic, and twigs were not susceptible to known magnetic action. Then known electrical actions persisted only if the systems were carefully insulated. The theoretical question, then, was whether dowsing had revealed a physical process to be added to the known processes of magnetism, electricity, and gravity. We shall see that, in the ensuing centuries, theories of electricity, magnetism, and gravity grew in strength. Yet accounts of the mechanism of dowsing languished. They lagged in their attempts to copy the latest developments in these other theories. By the end of the nineteenth century, there was no longer a theoretical niche in which dowsing processes could reside. There was no credible physical mechanism. We shall see that the most articulate of the proponents had to resort to clairvoyance and psychic processes as the foundation of dowsing.

3.1. The Effluvial Theory of Dowsing

Agricola ([1556] 1912) reported no theoretical foundation for the phenomenon beyond its similarity in some aspects to other processes, such as magnetic attraction. Here his level of reporting was comparable to that of Gilbert's *De magnete*, the influential treatise on electricity and magnetism published almost half a century later in 1600. His work was devoted to establishing the

3 For a brief history of this curious notion, see May (1979).

observed phenomena of magnetism and electricity and speculating about how the magnetism of the Earth might be associated with celestial processes. There was no detailed proposal for the mechanism of magnetic and electrical effects.[4]

Matters were soon to change. William Pryce's (1778) treatise on mining argued strongly in favor of the efficacy of dowsing. It included an extensive theory of the mechanism, formulated in terms of the effluvia proposed by the then popular corpuscular philosophy:

> It [the dowsing rod] was much talked of in France towards the end of the seventeenth century; and the corpuscular philosophy was called in to account for it. The corpuscles, it was said, that rise from the Minerals, entering the rod, determine it to bow down, in order to render it parallel to the vertical lines which the effluvia describe in their rise. In effect the Mineral particles seem to be emitted from the earth: now the Virgula [dowsing rod] being of a light porous wood, gives an easy passage to those particles, which are very fine and subtle; the effluvia then driven forwards by those that follow them, and pressed at the same time by the atmosphere incumbent on them, are forced to enter the little interstices between the fibres of the wood, and by that effort they oblige it to incline, or dip down perpendicularly, to become parallel with the little columns which those vapours form in their rise. (114)

Pryce turned from this report to an extended narrative aimed at establishing the plausibility of this theory of effluvia, drawing from the work of Robert Boyle (1673) though giving no citation to it. Perhaps he intended Boyle's energetic promotion and defense of effluvia. In any case, the effluvial theory described by Pryce bears a striking similarity to the effluvial theory of magnetism advocated by Descartes in his *Principles of Philosophy* ([1644] 1982, Part IV). Pryce concluded his defense of the effluvial theory with an analogy to magnetism. Effluvia from the Earth can magnetize iron as shown by

4 Contrary to some later reports (as given in Bynum, Browne, and Porter 1981, 111), the notion of *effluvia* seems to have no major role in *De magnete*. I found only one use of the word in the volume (Gilbert [1600] 1893, 78).

> . . . the polarity and magnetism of an old Iron bar taken from a church window, where it has stood upright for many centuries, is proved to derive its virtue from the magnetick effluvia of the earth. (116)

We are encouraged to make the unspoken inference that effluvia from mineral ores can also act on dowsers' twigs.

We can assess the equivocal status of the theory in the mid-seventeenth century of Descartes and Boyle from the latter's own synoptic report on dowsing. Boyle (1669, 92) concluded his essay "Of Unsucceeding Experiments" with the lament that, "What to determine concerning the truth of this perplexing experiment, I confess not to know."

3.2. Resistance by Skeptics

At the same time as proponents of dowsing were advancing theories of its operation, there was a persistent tradition of theoretical skepticism. Agricola's ([1556] 1912) earliest account of dowsing is often reported by proponents of it. They regularly omit mention of his astute skepticism of the process. Agricola noted how unlike dowsing was from the well-established processes of electrical and magnetic attractions:

> But, in truth, all those objects which are endowed with the power of attraction do not twist things in circles, but attract them directly to themselves; for instance, the magnet does not turn the iron, but draws it directly to itself, and amber rubbed until it is warm does not bend straws about, but simply draws them to itself. If the power of the veins were of a similar nature to that of the magnet and the amber, the twig would not so much twist as move once only, in a semi-circle, and be drawn directly to the vein. . . . (41)

Dowsing, Agricola noted, was a theoretical anomaly in his time whose properties were unlike electricity and magnetism. That, of course, precluded it from having an electrical or magnetic nature.

Since Pryce's (1778) work was a practical manual for mining, we should not expect it to provide the most up-to-date science. The effluvial theory of dowsing that Pryce reported represented the level of theorizing from a century earlier. At the time of his writing, physical theorizing had changed.

Descartes' qualitative speculations about effluvia had been replaced by quantitative measures of forces. Newton's precise quantitative account of gravity in his *Principia* of 1687 had supplanted Gilbert's speculation about the role of magnetism in celestial motions and Descartes' cosmic vortices. In 1785, seven years after Pryce's work was published, Charles Coulomb presented seven memoires to the French Académie royale des sciences in which he reported his careful quantitative measurements of electrical forces.

These theoretical troubles for dowsing continued. As long as theories of electricity, magnetism, gravitation, and other forces remained qualitative, dowsers could speculate that their twigs were responding to some combination of these forces within the standard scientific repertoire or some additional but analogous force. Over the course of the next 100 years, theories of electricity and magnetism matured into the precise electrodynamics of Maxwell, Hertz, Lorentz, and others still taught today as classical electrodynamics. Their theories annexed other processes. Light, it turned out, was merely a propagating ripple in the electromagnetic field. Although the heat of gases was reduced to random motions of their molecules, heat radiation was found to be just another portion of the electromagnetic spectrum.

With this maturation, the theoretical niche in which speculation about dowsing could flourish was gone. It was no longer plausible that metallic ores or water, buried underground, could exert some force on hazel twigs while evading the now thorough and quantitatively precise measurements of the nineteenth-century physicists. The skeptics, brandishing their mature theory of electrodynamics, were moving from success to success, from strength to strength, whereas the dowsers' theories were successively weakened and in retreat.

3.3. Collapse of the Dowsing Theory

Undeterred, proponents of dowsing continued to urge some sort of electrical or magnetic process as the basis of dowsing. By the later part of the nineteenth century, dowsing had become more prominent as a means of locating underground water. Latimer (1876, 26) claimed that it arose as an electrical effect: ". . . the friction of running waters underground produces an electric current which causes the switch to turn." In evidence, he recounted no exacting measurements, no experiments with running water, and no detailed computation within then developed theories of electromagnetism. Instead, he wore wooden sandals, insulated electrically from the ground by four ink

bottles, and attempted to dowse. So insulated, he noted (18) that his dowsing powers were extinguished.

While dowsing proponents persisted in these efforts, they became targets of derision by skeptical scientists. Charles Boys, the English experimental physicist, wrote a scathing review in *Nature* of Tompkins' 1899 volume *The Theory of Water Finding by the Divining Rod: Its History, Method, Utility and Practice*. Tompkins, Boys (1899, 2) reported, attributed the efficacy of dowsing to electrical action and quoted him as asserting the "well-known scientific fact that water is a generator of electricity." Elsewhere, he reported Tompkins asserting that minerals and water emit effluvia. Tompkins followed the tradition of dowsers who claimed that their method could detect much more than metallic ores and water. Their powers of detection extended to precious metals, including gold, boundaries, and murderers. To see whether the rod was detecting gold, one needed only to put gold in each hand, whereupon the motion of the rod ceased. Boys then mocked Tompkins:

> We can only infer that the murderer can be discriminated by putting a murderer in each hand, but this is not stated.

His sobering conclusion:

> But when they [dowsers] put forward preposterous "scientific explanations" such as I have extracted, it makes it very difficult not to come to the almost inevitable conclusion that the water-finder has no case. . . .

An anonymous reviewer of papers on dowsing by William Barrett and T.V. Holmes wasted no words on derision but dismissed without discussion the possibility that successful dowsing results from electrical action. The reviewer (Anonymous 1898, 353) wrote that,

> Moreover, as a physicist, he [Barrett] does not bring to this task any acquired training which is helpful in unravelling the problem; for the only point at which the divining rod touches physics — the assumption that electricity is its motive power — may be dismissed without investigation.

And still the dowsing theorists persisted. A later anonymous reviewer in *Nature* (Anonymous 1940) gave a much more restrained dismissal of

J. Cecil Maby and T. Bedford Franklin's 1939 *The Physics of the Divining Rod*. The authors had attempted to ground dowsing processes in something resembling contemporary physical theory. The reviewer's verdict was dry and devastating:

> The theoretical section, by the second author, postulates some form of cosmic radiation resulting in electromagnetic waves of ten metres wave-length. There seems to be no direct evidence for such waves, and the author's discussion of their polarization cannot be justified on our present knowledge.
>
> In presenting facts and theories to the scientific world, there is a well-accepted and necessary procedure. It is to be regretted that the authors have not followed this procedure, thus making the position of the scientific reviewer impossible.

A convenient marker of the collapse of a physical theory of dowsing was provided by the physicist and psychic researcher William Barrett. He investigated dowsing extensively, convinced himself of its reality, and provided a nonphysical explanation of it in his 1911 volume *Psychical Research*:

> The explanation, I believe, is not physical, but *psychical*. All the evidence points to the fact that the good dowser subconsciously possesses the faculty of clairvoyance, a supersensuous perceptive power such as we have described in a previous chapter. This gives rise to an instinctive, but not conscious, detection of the hidden object for which he is searching. (183; Barrett's emphasis)

The rod, on this account, is then moved by unconscious muscular action.

Today, over a century later, when clairvoyance has secured no scientific credibility, we find this retreat to clairvoyance a damning concession of failure. It would not have been so for Barrett. He was a founder of both the British Society for Psychical Research and the American Society for Psychical Research. They advocated the reality of psychic phenomenon and promoted research on them.

4. The Dispute over Geology

Once the locus of dowsing had moved toward detection of underground water, a new dispute emerged. Just how is the underground water sought by dowsers distributed? Dowsers portrayed the water as commonly residing in flowing streams. The flow of the water, as we saw above, is hypothesized to produce the electricity mediating in its detection. Latimer (1876, 23–24) boasted of his prowess as a dowser in locating a stream of water just ten feet from a well that had run dry and of locating a stream in a yard unfamiliar to him in the dark of night.

These findings are impressive only if the distribution of underground water is sparse and otherwise hard to locate. Critics, however, were quick to dispute this supposition. The anonymous reviewer reported above recorded Holmes, whose work was under review, as making the point clearly:

> He points out, in the first place, that the astonishment caused by the dowser's success is largely due to the fact that the dowser himself, and usually those who employ him, always believe that water-finding is a matter of locating a "spring," which it is possible to miss by a few inches, so that the achievement becomes as wonderful as finding a buried jar of ancient coins. But, as Mr. Holmes points out, while water sometimes runs in underground fissures, water bearing strata usually cover acres or miles, over any point in which a well may be successfully sunk. (Anonymous 1898, 355–56)

Similar points about the ease of finding water are made in an anonymously authored US Geological Survey pamphlet:

> The natural explanation of "successful" water dowsing is that in many areas water would be hard to miss. The dowser commonly implies that the spot indicated by the rod is the *only* one where water could be found, but this is not necessarily true. In a region of adequate rainfall and favorable geology, it is difficult not to drill and find water! (Anonymous 1988, 10; emphasis in the original)

Thomas Riddick (1951) makes the same point and many more in a scathing review of a book written by Kenneth Roberts about the well-established dowser Henry Gross. Riddick, a water-works engineer, decried at length Roberts' "apparent lack of even the most elementary knowledge of the principles of water-works engineering" (62). The title, "Dowsing Is Nonsense," does not hide the fury within the article.

5. Dispute over the Phenomena

5.1. The Early Dispute

Although dowsers maintained a healthy and profitable profession, there are reports from all eras that many in the mining industry itself were skeptical of the reality of the dowsers' powers of detection. Agricola ([1556] 1912, 40) reported it as "in dispute and caus[ing] much dissention amongst miners." Paracelsus was a contemporary of Agricola, both being born in 1493 or 1494. He gave a terse warning:

> You must take particular care, however, not to let yourselves be beguiled by divinations obtained through uncertain arts. These are vain and misleading; and among the first of them are the divining rods, which have deceived many miners.*[5] If they once point out rightly, they deceive ten or twenty times. (as translated in Waite 1894, 185)

The idea that we count both successes and failures in assessing dowsing was later refined greatly and became the basis of the twentieth-century statistical tests of dowsing reported below.

A century later Boyle (1669, 93) noted that "Among the Miners themselves I found some made use of this Wand, and other[s] laughed at it." Even Pryce (1778, 116) had to concede that "many deny, or at least doubt." Coupled with these doubts were strong suspicions that at least some dowsers were frauds and tricksters. Agricola ([1556] 1912, 41) obliquely suggested

5 Editor's footnote here: "Elsewhere Paracelsus says that it is faith which turns and directs the divinatory rod in the hand. — *De Origine Marborum Invisibilium*, Lib. I." I thank Jennifer Whyte for alerting me to Paracelsus' admonition. It must have been written prior to 1541, the year of his death.

deception in calling successful dowsers "cunning manipulators" and pointing out that a forked twig of flexible wood "turns in a circle for any man wherever he stands."

It is also striking that proponents of dowsing relied heavily on anecdotal evidence. Latimer (1876, 10) set out his agenda as "I think I have it in my power to demonstrate to you, principally from my own personal experiences — the relation of which I beg you to accept as strictly accurate. . . ." The demonstration then proceeded through a sequence of boasts of grand dowsing successes from his own professional practice. A favorite anecdote was of Jacques Aymar, who used his dowsing powers in 1692 to solve a notorious murder case in Lyon. The accounts of the episode, though supposedly based on objective contemporary accounts, read like a lurid detective novel, with astonishing moments of high drama. Barrett (1911, 172) included it in his history, favorable to dowsing, but did concede briefly that Aymar was "subsequently somewhat discredited owing to his failure in some tests. . . ." Barin-Gould (1877, 60–78) related the story in all of its lurid details. The account included Aymar's final entrapment in a test that resulted in Aymar being labeled an impostor and sent away "in disgrace" (77). Barin-Gould does not find, however, the exposé to be "conclusive evidence of imposture throughout his career" (78).

At least two commentators were not so credulous. In their colorful exposé of the folly of belief in dowsing, Ozanam and Montucla (1803, 259–67) left no doubt about their skepticism, calling dowsing "illusion, or philosophical quackery" (259–60). Their exposé included the tale of Aymar and suggested that his successful detection depended on ordinary, earlier knowledge of the murders.[6] They concluded their account of his fraud with a lament:

> How could rational minds imagine that an action morally bad, could communicate any physical quality to the authors of it? That the murderer of a human being, or stolen money, should have an effect on the rod, rather than the person who had killed a sheep, or money merely displaced? Those who can believe in such reveries must be exceedingly weak. (263)

6 They reported without giving the reason that "there is reason to think . . ." that Aymar had witnessed the murders. The remark might be more than a rhetorical flourish since they were French authors writing in France closer in time to the events.

5.2. The Modern Dispute

Such weakness persisted. At least as early as the late nineteenth century, proponents of dowsing sought more objective experimental evidence of dowsing. Hansen (1982) reviewed the previous century of experimental research on dowsing. The review provides an extensive synopsis of dowsing-related experiments of various types. For example, the "biophysical" seek to establish a dowser's sensitivity to electric and magnetic fields. The "physiological" seek to establish physiological responses of dowsers. There are many of these tests. The bibliography is over four pages long. However, the results are inconclusive. Hansen says in his final summary that,

> In spite of the large number of investigations made into dowsing, its status remains unclear. This is largely a result of sloppy experimental procedure and or report writing. (362)

It is hard to see how a century of such inconclusive investigation was anything other than a damning indictment of the physical reality of dowsing. It is supposedly an effect so strong that it can break dowsing twigs and lead dowsers to pass out or vomit. Yet a century of careful experimentation failed to establish it. We understand Hansen's curious conclusion best by recalling that the vehicle of publication for his review was the *Journal of the Society for Psychical Research*.

The strongest experimental evidence against dowsing has come in the form of controlled trials, which have occurred sporadically over the past century. Gregory (1929) collected and detailed the tests of dowsing then known to him, many of them unfavorable. Notable among them was a carefully constructed blind test organized by Sir John Cadman of the Anglo-Persian Oil Company (now British Petroleum) at its experimental station at Meadhurst, Sudbury-on-Thames, England, in 1925 (340–43). Dowsers were tested for their abilities to detect various combinations of buried deposits of water, oil, or empty barrels. The result was failure or, to quote Cadman, "a complete fiasco"; "in no case were the diviners able to show any justification for their contention that they could discover such deposits" (341).

In another such test, stage magician and parapsychology debunker James Randi (2020) organized a controlled trial of dowsing in Sydney, Australia, in July 1980. Dowsers were asked to identify which of ten buried pipes contained

running water. Despite their confidence, the dowsers performed merely at chance levels.

The largest test of dowsing abilities was conducted in Germany with a grant in 1986 of DM 400,000 from the government ministry Bundesministerium für Forschung und Technologie. It was completed in 1990. Some 500 dowsers were subjected to 10,000 individual tests. Most performed at chance levels. The few (forty-three) who showed more promise were subjected to further tests in a barn, in German *Scheunen*. These tests came to be known as the "*Scheunen* experiment." The dowsers were to locate a position on the barn's second floor directly above a water pipe placed randomly on the floor below. The experimenters proclaimed a successful demonstration of the reality of dowsing. A critic, however, found the experimenters' statistical analysis so flawed as to reverse their conclusion. Enright (1995, 360) concluded that

> A reexamination of the data on which that conclusion was based, however, indicates that no persuasive evidence was obtained for a genuine, reproducible dowsing skill. The absence of reproducibility suggests that the entire research outcome can reasonably be attributed to chance.

The German investigators (Betz et al. 1996) disputed this damning appraisal, and Enright (1996) reaffirmed it.

Although the practice of dowsing and disputes over it persist today, establishment skepticism of it has been unequivocal and well entrenched for over a century. A report in 1917 by the United States Geological Survey (Ellis 1917) responded to the "large number of inquiries received each year by the United States Geological Survey" about the efficacy of dowsing. The "Introductory Note" (5–6) was written by Oscar E. Meinzer, widely recognized as the founding figure of modern groundwater hydrology. His verdict was unequivocal:

> It is doubtful whether so much investigation and discussion have been bestowed on any other subject with such absolute lack of positive results. It is difficult to see how for practical purposes the entire matter could be more thoroughly discredited. . . . (5)

He went on to suggest that part of the dowsing profession is populated by swindlers who deliberately defraud people:

> To all inquirers the United States Geological Survey therefore gives the advice not to expend any money for the services of any "water witch" or for the use or purchase of any machine or instrument devised for locating underground water or other minerals. (6)

6. The Ideo-Motor Principle

This entrenched skeptical conclusion is that there is no real dowsing effect. This presents a problem for the skeptics. Some dowsers, presumably, are frauds and swindlers. However, many sincerely believe that they have the ability and have had the profound experience of their twigs or rods moving as if under the influence of powerful external forces. Why else would these dowsers allow themselves to be subjected to carefully controlled tests?

The skeptical response came in the codification of something long suspected: a sincere dowser might be unconsciously moving the twig. Ellis (1917, 16) noted the idea already advanced in the seventeenth century by Gaspard Schott and Athanasius Kirchner. The modern tradition was initiated by William Carpenter (1852). He argued that muscular motion might occur without one's conscious volition, and he dubbed the effect the "ideo-motor principle." It explains, he assured readers, "numerous phenomena which may have been a source of perplexity. . . ." They include

> . . . the movements of the "divining rod," and the vibration of bodies suspended from the finger; both which have been clearly proved to depend on the state of *expectant attention* on the part of the performer, his Will being temporarily withdrawn from control over his muscles by the state of abstraction to which his mind is given up, and the *anticipation* of a given result being the stimulus which directly and involuntarily prompts the muscular movements that produce it. (153; Carpenter's emphasis)

This possibility had an immediate application in England in the mid-nineteenth century when interest in spiritualism was growing. Participants in séances were startled to find the table under their hands moving even though no one was consciously moving it. Michael Faraday, then an eminent experimental scientist, devised a simple test. He placed stacks of cardboard and other materials under people's hands resting on the table in the séance. The stacks were devised so that they would respond differently according to whether the sitters' hands were moved by the table that moved first or whether their hands moved first and pushed the table. The latter case was demonstrated unequivocally. Faraday reported his results in a letter to the London *Times* on June 30, 1853.[7]

This ideo-motor principle or just the idea of unconscious movement enabled skeptics to account for how sincere dowsers might nonetheless find their twigs moving, as if under some external power. It also explained why sincere dowsers were so successful in controlled trials when they knew where the target was but failed when they did not. Indeed, it could even account for some of the limited successes of dowsers. As has often been noted, there are ordinary clues above ground that a dowser might unwittingly discern. Gregory (1929, 331) concluded that

> Hence a man going over a tract of ground may notice signs of water unconsciously, and some slight mental action may cause the twitching of a finger and a jerk of the rod. While some dowsers may be deliberate frauds, and others may be duped by their vanity, many of the best dowsers probably act by their dissociated mental activities.

The flexibility of the ideo-motor principle also proved to be useful to proponents of dowsing. When it had become increasingly clear that dowsing did not operate by familiar physical processes such as electricity and magnetism, we saw above that Barrett (1911, 183) resorted to clairvoyance as the active mechanism. But how might a clairvoyant thought be known by the dowser's twig? Unconscious muscular movement by the dowser transmits it, Barrett concluded.

7 Presumably, he knew of Carpenter's proposal since Faraday was a contributor to the volume of the *Proceedings* in which Carpenter's paper appeared. For an account of the origin and development of the idea of ideo-motor action, see Hyman (1999).

7. The Diverging Inductive Logics

The preceding sections have recounted the dispute among proponents and skeptics of dowsing over which are the facts governing dowsing. According to the material theory of induction, different facts will support different inductive logics. Since these differences among the facts proposed and presumed by each group are large, we should expect and will find these differences reflected in differences in their inductive inferences.

The easiest to see arises from differences in views over the facts of the geological distribution of the water sought by dowsers. If one believes with the dowsers that underground water is distributed sparsely in veins, then one will infer that a dowser's successful prediction of the location of water provides good inductive support for the efficacy of dowsing. Success, if dowsing were ineffective, would be unlikely. If, however, one believes with the skeptics that water is often distributed broadly in readily accessible water tables, then one will find a dowser's successful prediction of the location of water to be evidentially inconsequential. The success is assured independently of any special power of the dowser.

A richer divergence in the inductive logics derives from differences over whether there is a real physical process directly connecting the dowser's target and the movement of the dowser's twig. If one believes with the mainstream of dowsers that there is such a process, then a dowser's success is expected and provides additional support for facts already believed, the efficacy of dowsing. The problematic cases are those in which dowsing fails. In that circumstance, under this logic, we have evidence for a secondary disturbing process or other confounding factor resulting in the failure. The research agenda is to find it. We have seen already that such failures might be explained by proponents of dowsing in a way familiar even to modern parapsychologists — in Agricola's ([1556] 1912, 39) words, "some peculiarity of the individual, which hinders and impedes the power of the veins."

If, however, one believes with the skeptics that no real physical process directly connects the dowser's target and the movement of the dowser's twig, then matters are exactly reversed. The failure of a dowser is expected and provides additional support for facts already believed, the inefficacy of dowsing. The successes are the problematic cases. They are evidence for some secondary process that emulates successful dowsing. The research agenda is to find it. Perhaps the dowser unconsciously reacted to ordinary signs of the target,

or success was assured by the prevalence of water, or the reports of success are exaggerated or heavily selected.

These last remarks pertain just to the beliefs of the two sides regarding which are the prevailing facts and thus which are the appropriate inductive inferences. Of course, at most, one of these logics can be applied correctly to dowsing. That one logic is determined by which are the facts actually prevailing over dowsing.

8. Conclusion: The Inductive Instability

I can now summarize the inductive instability that led to the collapse of the credibility of dowsing and the evidential dominance of the skeptics. Initially, when the practice first emerged in the sixteenth century, neither proponents nor skeptics could claim a decisive advantage. If anything, skeptics were at a striking disadvantage, for dowsing was an established practice. Its operation was directly visible in the unambiguous motions of the dowsers' twigs, and there was a financially successful profession of dowsers serving the mining industry. What followed was a steady stream of self-reinforcing victories by the skeptics that so weakened the dowsers' claims that they lost scientific credibility.

As far as the observed reality of the process itself was concerned, the evidential case was unstable, at least in the shorter term. The successes of dowsers strengthened their case and weakened that of the skeptics. Correspondingly, the failures reversed these judgments. These failures were a concern for dowsers from the start, for there were always skeptics who suspected self-deception and even dishonesty by the dowsers. An enduring history of failures is more damaging to the dowsers than to the skeptics, for the dowsers make the positive claim of the existence of a definite process. Yet they are unable to delineate the precise conditions under which that process is guaranteed to appear. Pryce (1778, 116), who championed the efficacy of dowsing, curiously had to concede that he himself was unable to dowse:

> As many deny, or at least doubt, the attributed properties of the divining rod, I shall not take upon me, singly to oppose the general opinion, although I am well convinced of its absolute and improveable virtues. It does not become me to decide upon so controvertible a point; particularly, as from my

> natural constitution of mind and body, I am almost incapable of co-operating with its influence; and, therefore, cannot, of my own knowledge and experience, produce satisfactory proofs of its value and excellence.

That is troublesome for an effect supposedly akin to the reliable processes of magnetism and electricity. The persistence of these failures over the centuries must erode the strength of support for dowsing.[8]

The identification of ideo-motor effects in the nineteenth century gave a new advantage to the skeptics at the expense of the dowsers. Pryce had emphasized the honesty and reliability of those giving favorable observational reports of dowsing. He wrote of one,

> . . . my worthy friend Mr. William Cookworthy, of Plymouth, a man, not less esteemed for his refined sense and unimpeachable veracity, than for his chemical abilities. (1778, 116)

Just as the honesty of this observer weighed favorably on Pryce, so too does the sincerity and honesty of at least some of the dowsers who appear to practice dowsing successfully. This part of the case for dowsing was now eliminated. Ideo-motor effects gave skeptics a serviceable account of the illusion of the effectiveness of dowsing. The ideo-motor effects were reproducible reliably. The effect would be present just when the agent knew the targeted answer.

Finally, failures of controlled trials of dowsing completed the experimental side of the skeptics' case.

In parallel with these developments, the strengthening of theories of magnetism, electricity, gravitation, and more left no theoretical niche for the physical processes that would have to mediate in dowsing, if the effect was real. The process unfolded in an instability in which successes by the skeptics strengthened their case while weakening that of the dowsers. That is, as theories of electricity, magnetism, and other physical forces advanced, the theoretical niche available for the physical basis of dowsing contracted. The dowsing theorists were perpetually retreating and shifting their theoretical ground with yet another speculation. Meinzer gave an acerbic appraisal:

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8 Here we might compare their continuing difficulties with the comparable problem faced by proponents of cold fusion to produce the effect reliably in the laboratory. See Norton (2021, Chapter 4, Section 5).

> A favorite trick for appealing to uneducated persons and yet making specific disproof impossible is to give as the working principle of such a [dowsing] device some newly discovered and vaguely understood phenomenon, as, for example, radioactivity. (Ellis 1917, 5)

Dowsers repeatedly retreated to speculations within existing theories that fell far short of professional standards and then finally to suppositions of psychic effects.

These two observational and theoretical tracks were also mutually reinforcing. When observational or experimental tests fail to manifest an effect, there is always some possibility that a different set of conditions might nonetheless produce it. The skeptics could dismiss this possibility by pointing to the lack of a theoretical niche in known physics for processes that could mediate in dowsing. The skeptical theorists, however, could worry that their theories had failed to probe all of the material processes in their domain of investigation. These theorists could reassure themselves that they had not missed some novel process at work in dowsing by pointing to the failure of objective testing to discover any such process.

In sum, the early viability of both proponents' and skeptics' positions was unstable under further investigation. As those investigations proceeded, on the experimental and theoretical tracks, they favored the skeptics. The investigations reinforced each other, accelerating the skeptics' advantage and leading to their evidential dominance.

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