Scientists use several rhetorical strategies to heighten the objectivity and credibility of their findings. Examples are the rhetoric of effort, which involves emphasizing the amount of effort expended in research, and the rhetoric of self-effacement, which involves suggesting that the facts have manifested themselves without input from the researcher. In this article, I present a further, hitherto unrecognized rhetorical strategy that scientists use for the same aims: the rhetoric of effortlessness, which consists in conveying the impression that establishing a result has cost the investigator little effort. This rhetorical strategy heightens the credibility of individual scientific findings, raises the reputation of individual scientists, and propagates an attractive view of science as a whole. I outline the epistemology underpinning the rhetoric of effortlessness and give examples of its use in modern science.

1. Introduction

Some classic historical vignettes depict scientists achieving breakthroughs without effort: Archimedes grasping the principles of buoyancy while bathing, Galileo Galilei discovering the isochrony of the pendulum while sitting in a cathedral, James Watt noticing the motive power of steam while passing time in a kitchen, Alexander Fleming finding penicillin in Petri dishes that he had omitted to clean before going on holiday (Jaeger 2008, pp. 17–31; Shea 1972, p. 3; Miller 2004; Macfarlane 1984, pp. 117–138). These stories suggest that, to establish important findings in science, hard work is not always necessary.

I thank three unnamed referees and the editor for their constructive criticism, which resulted in several improvements.
In this article, I suggest that such stories capture an important aspect of scientific practice and of the rhetoric of science. I show that scientists sometimes follow a rhetorical strategy that consists in portraying scientific discovery as having required little expenditure of effort. This rhetorical strategy raises the credibility of a scientific finding in two ways: the fact that a finding required little effort suggests that it is strong and trustworthy, while the fact that the scientist achieved the finding with little effort enhances the scientist’s credibility. I distinguish this rhetorical strategy from two other strategies that are already known in the science studies literature: the strategy of emphasizing the amount of effort that has gone into establishing a scientific finding, and the strategy of erasing the researcher from the discovery account.

In the next section, I review the existing literature in science studies on rhetorical strategies that scientists use to heighten the credibility of their claims. In section 3, I introduce the rhetoric of effortlessness and investigate its epistemology: I show how depicting a line of research as having cost little effort buttresses both the claim that the results are objective and the claim that the researcher has special competence. I compare the rhetoric of effortlessness with the rhetorical strategies that are already known in the science studies literature in section 4. The next two sections are devoted to historical exemplification: I analyze some uses of the rhetoric of effortlessness at the hands of scientists in section 5, and at the hands of historians of and other commentators on past science in section 6. I draw some conclusions in section 7.

2. Rhetorical Strategies and the Credibility of Scientific Findings

Scientists use several rhetorical strategies to heighten the credibility of their findings. Some of these strategies offer solutions for the fundamental problem of the objectivity of science: how can claims about nature be objective if human investigators play a part in generating and establishing them? Such rhetorical strategies implicitly present an account of the role of the scientist in constructing matters of fact that resolves the apparent tension between human agency and the achievement of objectivity.

Scholars in science studies have previously discussed at least two such rhetorical strategies. The first consists in heightening the credibility of a result by emphasizing the magnitude of the effort that scientists expended in establishing it. I dub this strategy the “rhetoric of effort.” The rhetoric of effort is based implicitly on a view of science as painstaking labor, often by groups of people working together, to achieve a reliable outcome. At its simplest, the rhetoric of effort may take the form of emphasizing that one has performed a large number of observations, raising the likelihood of an inductive generalization. More specific forms of this rhetorical strategy may consist in emphasizing the care taken to avoid errors and the power of the experimental apparatus used.
For example, physicists engaged in precision research, such as measuring the value of constants of nature and other physical parameters, heighten the credibility of their findings by displaying the care with which they have calibrated instruments and have controlled for sources of experimental error (Wise 1995; Gooday 1997). The credibility of results in biomedical research, similarly, often depends on showing that the investigators have followed agreed protocols conscientiously. Researchers in these areas often devote the “materials and methods” sections in journal articles to enumerating the procedures and checks that they have applied. Researchers in high-energy physics frequently emphasize the power and sophistication of their apparatus in order to evoke trust in their claims: particle physicists often open conference presentations with photographs of impressive experimental installations, for instance (Traweek 1992, p. 429).

The suggestion implicit in the rhetoric of effort is that human agency approximates to objectivity if it is exercised strenuously enough. By contrast, skimping on effort—making fewer observations, taking less care to avoid errors, economizing on apparatus—would be likely to yield less trustworthy results.

The second rhetorical strategy for heightening the credibility of scientific findings that is well known in the science studies literature takes the opposite tack: it consists in conveying the impression that the findings have come to light with no input whatsoever from the investigator. This strategy might be dubbed the “rhetoric of self-effacement.” Accounts of scientific work that use this strategy suppress the agency of the investigator and present scientific results as manifesting themselves. In consequence, the identity of the scientist whose name is attached to a finding is seemingly irrelevant: scientists are interchangeable, since the same facts would emerge irrespective of who reported them. Objectivity is a matter of intervening in or interfering with nature as little as possible: by the same token, this strategy can be said to achieve intersubjectivity, as any difference of perspective vanishes when the human subject drops out of the picture.

Modern scientists are taught to use the rhetoric of self-effacement in writing, especially in formal published reports. Impersonal grammatical constructions, such as the remote third person, dummy subjects, and passive verbs with suppressed persons, have become standard usage in English-language journal articles in the natural sciences since the end of the eighteenth century. Passive verb constructions are especially useful: they enable the writer to avoid personal pronouns and to thematize and present as “given” the inanimate elements that, in an active clause, would be a syntactic object. These linguistic resources enable the writer to describe the process of establishing findings without mentioning any human agent. Many authors in science studies have discussed the rhetoric of self-effacement in scientists’ writing (Bazerman...
1988; Gross 1990; Gross, Harmon, and Reidy 2002): they have devoted particular attention to the use of the passive voice (Ding 1998).

A form of the rhetoric of self-effacement is also available in visual communication. In their discussion of the changing standards of objectivity in scientific images, Lorraine Daston and Peter Galison (2007, pp. 115–190) identified the heyday of what they called “mechanical objectivity” in the 1880s and 1890s. Photography and other recently invented techniques for mechanical registration of traces allowed nature to appear in an image seemingly uninfluenced by human intervention. Emphasizing the automaticity of the process that produced the image was an effective rhetorical strategy in this context. According to Daston and Galison, the dominant epistemology of scientific images shifted from this ideal of mechanical objectivity to that of expert judgment early in the twentieth century.

In what follows, I focus attention on a third rhetorical strategy, different from the rhetoric of effort and of self-effacement, which modern scientists use to heighten the credibility of their claims: the “rhetoric of effortlessness.”

3. Epistemology of Effortlessness
The rhetoric of effortlessness consists in conveying the impression that, whereas a particular investigator was responsible for a finding, establishing that finding cost that investigator little mental, physical or social effort (McAllister 2006). Conveying the impression that an investigator’s establishing a finding cost him or her little effort has various useful effects: it heightens the credibility of the finding, it raises the reputation of the investigator, and it constructs an attractive image of science. Effortlessness produces these effects via three pathways.

Pathway 1 goes through the nature of the finding: it rests on the traditional view that truths are natural and discovered, whereas departures from the truth are artificial and constructed. From this, it follows roughly that any conclusion established with little effort is likely to be true, whereas conceiving a falsehood requires more effort. A self-evident truth is certainly one that can be grasped with little effort. Appearing to expend little effort in establishing a finding is, on this premise, a good way of buttressing one’s claim to have uncovered the truth: any more effort would raise suspicions that one had constructed a falsehood instead.

For example, a signal in the experimental data that can be detected with ease must correspond to a conspicuous and stable natural phenomenon, one may think, and is therefore trustworthy. By contrast, a signal that can be detected only with much manipulation is more likely to be an ephemeral effect or a measurement artifact.

The suggestion that a scientific finding that can be established with little effort is likely to be true is related to the traditional belief that lying takes
more effort than telling the truth. Cognitive psychologists have offered some support for this belief: they have found that engaging in deception imposes a greater cognitive load on subjects than reporting what one believes to be the facts (Spence et al. 2004). This result is exploited in lie detection: if a story is true, an informant should be able to recount it with little cognitive effort, and thus should be able to recount it even when burdened by other cognitive tasks (Vrij 2008, pp. 39–41).

Pathway 2 goes through the route taken to the finding. If a researcher has established a finding with little effort, he or she must have followed an economical route to it. Such a route is smooth and straightforward, and does not involve such things as intractable problems, long chains of reasoning, and choices between alternative continuations. All these would raise the chance of error and uncertainty. Thus, the existence of an economical route to a finding, which is demonstrated by the researcher’s expending little effort, suggests that the finding is trustworthy.

Furthermore, advertising that a researcher has expended little effort suggests that he or she followed this economical route efficiently: he or she carried out no unnecessary work, postulating superfluous entities, pursuing false leads, committing and rectifying mistakes or embellishing results. These assurances help, again, to raise confidence in the findings reported.

Pathway 3, lastly, goes through the attributes of the researcher. Since it takes special insight to identify an economical route to a finding, advertising that a researcher followed an economical route suggests that he or she is highly talented—in particular, more talented than a scientist who took a less economical route. In turn, the researcher’s talent suggests that he or she is unlikely to commit blunders, and thus that this finding, together with other findings that the researcher may report, can be trusted. This pathway raises the reputation of a scientist also in a further way: it suggests that he or she has held powers in reserve, and would be capable of establishing even more impressive findings if he or she chose to exert these in full.

These three pathways explain how portraying scientific findings as effortless enables researchers and commentators on science to heighten the credibility of those findings.

To see how the pathways work, take the Archimedes discovery story as an example. Let us assume for simplicity that, in this episode, Archimedes discovered the principles of hydrostatics (historical accounts differ on what Archimedes actually concluded or might have been justified in concluding, but that is not relevant here). If the principles of hydrostatics are such that merely lowering oneself into a bathtub is sufficient to manifest them, then they must be a strong and stable natural phenomenon, rather than, say, the result of a contrived combination of circumstances (pathway 1). If Archimedes needed only note the displacement of the bathwater to reach the principles of
hydrostatics, then there was little scope for error or uncertainty in his route to the finding (pathway 2). If Archimedes appreciated that this everyday experience revealed the principles of hydrostatics, lastly, then he was an exceptionally perceptive observer, and the reports of such an observer can be trusted (pathway 3).

Portraying a discovery as achieved by serendipity, as Fleming’s discovery of penicillin is usually portrayed, is another way of invoking effortlessness to heighten the credibility of findings. Someone who comes across a new phenomenon by accident can certainly be said to have expended little effort. The paucity of effort required is confirmation that the phenomenon has been discovered—and so is objective—rather than having been constructed: the phenomenon “came out of the blue” to strike the researcher (pathway 1). Because the observation apparently required no preparation or manipulation, it is hard to see how any fault or doubt could arise in the run-up to the discovery (pathway 2). Yet, a discovery by serendipity, precisely because it is unexpected, requires a particularly acute observer. This boost in reputation reflects back onto the finding: such an acute observer is unlikely to be mistaken (pathway 3).

The three pathways linking effortless with credibility deliver good cognitive reasons for believing a claim. The fact that an experimental result is achieved and replicated with ease is indeed evidence for thinking that it corresponds to a strong and stable natural phenomenon, for example, and the fact that a researcher shows talent by achieving results with little effort is a justification for trusting his or her claims. My calling this strategy “rhetoric of effortlessness” thus emphatically does not mean that it is a dishonest or specious technique of persuasion. On the other hand, of course, a scientist in reality is invariably compelled to exert considerable efforts behind the scenes to establish any substantial finding. Even so-called flashes of insight and instances of serendipity usually rest on much incubation or preparation. The rhetoric of effortlessness thus consists partly in concealing or downplaying the effort exerted in scientific work.

These three pathways operate in all types and phases of scientific work. They apply clearly to discoveries that take the form of a “eureka moment” in which an individual scientist makes an instantaneous discovery, like the cases of Archimedes, Galileo, Watt, and Fleming with which I opened the article. However, they operate also in procedures aiming at validation rather than discovery, procedures consisting of distinct acts extended in time, such as deductive reasoning, mathematical demonstrations, and programs of experiments or fieldwork, and procedures carried out by teams of researchers. All such procedures, if they seem to involve a comparative economy of effort, may be described in terms of effortlessness, even though the absolute amount of effort involved is greater than in a eureka moment.

As well as heightening the credibility of individual scientific claims and the reputation of individual investigators, lastly, the rhetoric of effortlessness
influences how we think of science as a whole. It propagates a seductive image of science as an immaterial, ethereal, leisurely, even at times aristocratic endeavor, achieved by scientists with easy grace and naturalness, not like the hard toil of other occupations. This image of science is a prominent and familiar element of how we think of science. Correspondingly, the rhetoric of effortlessness has a hermetic effect: it tends to render science an opaque, unanalyzable activity, making it difficult to understand the origin of findings.

4. Three Rhetorical Strategies: A Comparison

How does the rhetoric of effortlessness differ from the two rhetorical strategies that have already been identified in the science studies literature, reviewed in section 2?

The rhetoric of effortlessness is, naturally enough, diametrically opposed to the rhetoric of effort: the one links objectivity to the expenditure of increasing amounts of effort, the other to the avoidance of effort. Many scientists and writers on science are aware of the contrast between effort-intensive and effort-saving approaches in establishing results. Michael F. Atiyah distinguishes “powerful” and “elegant” approaches in mathematical arguments:

All of us have some idea of what the distinction is. A powerful argument need not be elegant, it can be a brute force fact which succeeds by sheer strength, a bulldozer technique, you just plough ahead with pages full of formulae, it looks ugly, it is ugly, but it gets there. With the elegant approach you seem to be doing no work, you write along for a few pages and, lo and behold, a brilliant result appears at the end much to everybody’s surprise (Atiyah 1974, p. 234).

Both of these approaches heighten the credibility of the results and evoke admiration for the researcher in different ways: the effort-intensive approach by virtue of the magnitude of the intellectual resources, and the effort-saving approach by virtue of the transparency of the means and the astute choice of route.

In some cases, commentators on science employing the rhetoric of effort treat the rhetoric of effortlessness as a foil. Here is an illustration, which plays off a Gauss anecdote that also involves the summation of mathematical series, which I will describe in section 5 below. As Paul Halmos recalls, someone challenged John van Neumann to the following puzzle: two bicycles starting 20 miles apart move towards one another, each at 10 miles per hour. A fly flies back and forth between them at 15 miles per hour. How far does the fly travel before the bicycles collide? There is a “trick” available, which consists in noting that the bicycles meet after exactly one hour, in which time the fly covers 15 miles. “When the question was put
to von Neumann, he solved it in an instant, and thereby disappointed the questioner: ‘Oh, you must have heard the trick before!’ ‘What trick?’ asked von Neumann; ‘all I did was sum the infinite series’” (Halmos 1973, pp. 386–7). The story depicts von Neumann declining to take an available effort-saving route to the result; instead, he chose an effort-intensive route—only, his calculating power was so great that he was able to accomplish in a second what would represent an impossible task for a lesser mathematician. In this story, the effort-intensive route heightens the talent of the researcher—and, thereby, the credibility of his results—even more than the effort-saving route would have: as Halmos comments, “The speed with which von Neumann could think was awe-inspiring” (Halmos 1973, p. 386).

Now to compare the rhetoric of effortlessness with the rhetoric of self-effacement. In some respects, one might see the latter as an extreme variant of the former: maintaining that a task has involved no human agency at all would seem to be a good way of suggesting that no human effort has been expended on it. There is, however, a big difference between the rhetoric of self-effacement and the rhetoric of effortlessness when it comes to claiming and attributing personal credit for findings. Because the objectivity of findings in the rhetoric of self-effacement is tied to lack of human involvement, as we noted in section 2, that rhetorical strategy writes individual scientists out of the story for the sake of portraying their results as objective. At a minimum, the rhetoric of self-effacement suggests that the identity of scientists is immaterial, since any other scientist would have reached the same conclusions. In the rhetoric of self-effacement, therefore, the portrayal of findings as objective works against a researcher’s effort to claim personal credit for them.

In the rhetoric of effortlessness, by contrast, establishing a finding with economy of effort is an achievement that attaches to an individual, identified scientist. It enables the scientist to differentiate him- or herself from the multitude of other scientists who would have needed more effort to establish the same finding. In the rhetoric of effortlessness, thus, the grounds for regarding findings as objective are simultaneously grounds for claiming overt personal credit for those findings. For example, the Archimedes story, which shows Archimedes reaching the principles of hydrostatics with little effort, has the effect of increasing both our belief in the principles and our admiration for Archimedes. The rhetoric of self-effacement, by contrast—“as the body was lowered into the bath, the water level was observed to rise”—would have the effect of concealing the author of the discovery.

For the individual discoverer, therefore, the rhetoric of effortlessness is an exceptionally productive solution of the problem of reconciling human
agency with the objectivity of science. Its advantage over the rhetoric of self-effacement is clear.

5. Rhetoric of Effortlessness in Scientists’ Presentations

Two groups of people use the rhetoric of effortlessness, like other rhetorical strategies to heighten the credibility of findings: scientists use it to present their findings to colleagues and other audiences shortly after reaching them, and historians and other writers use it in commenting retrospectively on scientists’ work and on the progress of science. We will look at the use of the rhetoric of effortlessness by the first group in this section and by the second group in the next.

A scientist can convey an impression of effortlessness in three ways. First, a scientist can portray the results of his or her work as simple, and appeal tacitly to the assumption that a simple result is achieved with little effort. Second, a scientist can describe a piece of work as having required little effort, thanks both to a judicious choice of route and therefore—explicitly or implicitly—to special talent on his or her own part. For example, elegance in reasoning or in experimental design is often cited as indicating that a scientist exerted only the minimal effort necessary to establish a finding. In all these ways, the scientist emphasizes the disparity between the magnitude of the result achieved and the slenderness of the means employed.

Third, the impression of effortlessness is reinforced if an account of the research itself seems effortless. The scientist thereby appears to demonstrate mastery over the material both in the phase of establishing results and in the phase of presenting them to others. Content and form fuse to yield a single persuasive whole, as is the norm in rhetorical strategies.

Are scientists’ formal published research reports a good place to look for examples of the rhetoric of effortlessness? We know that scientists in journal articles routinely understate the amount of effort that they have expended: they omit mention of alternatives pondered, false leads pursued, failed experiments, and mistakes rectified (Holmes 1987). By doing so, scientists strive to play down the incidence of construction, choice, and contingency in their work and present their claims as natural and inescapable. Scientific publications would look different if the community adopted the proposal of H. M. Collins (2001) that scientists should honestly estimate the amount of effort that they had expended in their research.

However, the dominant rhetorical strategy in formal published research reports today remains the rhetoric of self-effacement, as we saw in section 2. This means that, rather than claiming credibility for results by virtue of the paucity of effort expended, scientists in journal articles tend to rely on the conception that the facts have emerged with no human involvement.
Modern scientists use the rhetoric of self-effacement much less in two other settings, by contrast. The first of these is private, informal interactions of scientists with their colleagues. Ethnographic studies of laboratory work have suggested that this discourse usually takes the form of narratives of personal experience that portray the subject as taking actions to establish results and to overcome obstacles (Gilbert and Mulkay 1984; Lynch 1985; Latour and Woolgar 1986, pp. 154–68).

The second setting is oral presentations of scientific findings to an audience. Oral presentations, unlike publications, offer the sight of a flesh-and-blood speaker at the podium, which unavoidably reminds the audience of the agency involved in making science. The format of oral presentations, moreover, invites the speaker to indicate his or her involvement with the subject matter and with the audience (Chafe and Danielewicz 1987; broader studies of the language and rhetoric of academic lectures include Goffman 1981, pp. 160–96; Tannen 1988; Rowley-Jolivet 2002; Clark 2003). Scientists therefore rarely use the rhetoric of self-effacement in oral presentations. For example, they use passive verb constructions much less in oral presentations than in publications, as Elizabeth Rowley-Jolivet (2001) has found. Instead, scientists in oral presentations tend to refer to themselves explicitly as agents in the construction of scientific knowledge.

As a result, scientists’ oral presentations are a fruitful place to look for instances of the use of the rhetoric of effortlessness to buttress claims to objectivity and credibility. In this section, I have chosen brief examples of oral presentations of three forms: public lectures to non-specialist audiences, didactic lectures to students, and research presentations to peers in scientific conferences. In each case, the speaker used the rhetoric of effortlessness to heighten the credibility of the findings being described.

We start with Michael Faraday. Faraday was aware of the rhetorical aspects of scientific lectures from an early age. In a letter to Benjamin Abbott in 1813, at age 21, Faraday explained that a lecturer should project an air of ease and naturalness:

> A Lecturer should appear easy & collected undaunted & unconcerned his thoughts about him and his mind clear and free for the contemplation and description of his subject. His action should not be hasty and violent but slow easy and natural consisting principally in changes of the posture of the body in order to avoid the air of stiffness or sameness that would otherwise be unavoidable. (James 1991, p. 61)

Faraday conceded that lecturers might prepare a written text:

> But ’tho I allow a Lecturer to write out his matter I do not approve of his reading it at least not as he would a quotation or extract he
should deliver it in a ready and free manner referring to his book merely as he would to copious notes and not confining his tongue to the exact path there delineated but digress as circumstances may demand or localities allow. (James 1991, p. 61)

Here, Faraday recommended adopting an undidactic, conversational style, giving the impression that the presentation came naturally to the lecturer, and was not the result of drilling or a mechanical reproduction of a prepared text. These are classical rhetorical devices to convey the impression of an effortless performance.

Faraday put his own precepts into practice in his Friday Evening Discourses at the Royal Institution in London between 1825 and 1860. At these events, which combined lectures and experimental demonstrations, Faraday often presented his own discoveries in chemistry, electromagnetism, and other fields. Faraday did not employ the rhetoric of self-effacement: on the contrary, he emphasized his personal role in establishing these findings. He was able to combine a claim to personal credit with an assertion of the objectivity of his findings by means of the rhetoric of effortlessness.

Faraday’s discourses were celebrated among his fashionable audience for their ease and naturalness. According to Henry Bence Jones, the secretary of the Royal Institution who wrote a biography of Faraday, “his manner was so natural, that the thought of any art in his lecturing never occurred to anyone” (quoted from Morus 1998, p. 29). The resulting image of effortlessness played an important part in heightening the credibility of Faraday’s scientific findings, in enhancing his own reputation, and in conveying an appealing image of science to an audience drawn mainly from the leisured classes (Gooding 1985; Morus 1998, pp. 13–42).

In fact, the impression of naturalness was achieved at the cost of hard work behind the scenes. First, Faraday had developed his presentation skills: as a laboratory assistant, he had taken elocution lessons to improve his speaking and stage manner. Second, his experimental demonstrations during the discourses rested on meticulous preparation. Silvanus P. Thompson reveals this in his biography of Faraday:

For his Friday discourses, and for his other set lectures in the theatre, he always made ample preparation beforehand. His matter was always over-abundant, and, if his experiments were always successful, this was not solely attributable to his exceeding skill of hand. For, unrivalled as he was as a manipulator, in the cases in which he attempted to show complicated or difficult experiments, that which was to be shown was always well rehearsed beforehand in the laboratory. (quoted from Morus 1998, p. 29)
The twin aspects of Faraday’s way of working—appearance of serene effortlessness, painstaking preparation behind the scenes—help explain why biographers of Faraday have been divided between two images of him: the Romantic genius who achieved discoveries on the strength of ineffable intellectual qualities, and the blacksmith’s son and working-class hero who reached a high position by dint of hard work and self-improvement (Cantor 1996).

The second type of oral presentation is the didactic lecture to students. Many physicists who knew him suggested that Enrico Fermi embodied to a high degree the ideal of effortlessness in scientific work. Hans Bethe wrote:

My greatest impression of Fermi’s method in theoretical physics was of its simplicity. He was able to analyze into its essentials every problem, however complicated it seemed to be. He stripped it of mathematical complications and of unnecessary formalism. [ … ] This method was particularly impressive to me because I had come from the school of Sommerfeld in Munich who proceeded in all his work by complete mathematical solution. [ … ] Sommerfeld’s way was a good one for many problems where the fundamental physics was already understood, but it was extremely laborious. It would usually take several months before you know the answer to the question. It was extremely impressive to see that Fermi did not need all this labor. The physics became clear by an analysis of the essentials, and a few order-of-magnitude estimates. [ … ] He was a master at achieving important results with a minimum of effort and mathematical apparatus. (quoted in Segrè 1970, pp. 59–60)

Fermi communicated the same impression of effortlessness also in his teaching, according to his colleague, Chen Ning Yang:

As is well known, Fermi gave extremely lucid lectures. In a fashion that is characteristic of him, for each topic he always started from the beginning, treated simple examples and avoided as much as possible “formalisms”. [ … ] The very simplicity of his reasoning conveyed the impression of effortlessness. But this impression is false: The simplicity was the result of careful preparation and of deliberate weighing of different alternatives of presentation. In the spring of 1949 when Fermi was giving a course on Nuclear Physics [ … ], he had to be away from Chicago for a few days. He asked me to take over for one lecture and gave me a small notebook in which he had carefully prepared each lecture in great detail. He went over the lecture with me before going away, explaining the reasons behind each particular line of presentation. (Yang 1965, p. 673)
In his lectures, Fermi concealed the effort required to make the choices that underpinned his exposition. He thereby gave the impression that both the material itself and his presentation of it were natural and inevitable.

The third and final type of oral presentation is the conference talk delivered to fellow researchers. Many speakers at conferences in the natural sciences today cultivate an air of effortlessness. Their performance is seemingly extemporaneous and nonchalant: instead of reading from a manuscript, for example, they speak informally using slides as visual cues. Moreover, they tend to use plain language: while employing whatever technical terms and expressions are standard in their field, they avoid artful or conspicuously elegant linguistic constructions. The message conveyed is that the speaker has put no surplus effort into preparing the presentation: he or she has done merely the work necessary to place the facts before the audience.

This tallies with the advice of Çiğdem İşsever and Ken Peach on giving scientific presentations:

> We scientists are a sceptical bunch ... systematic doubt is at the heart of the scientific method. We therefore tend to distrust a presentation that is too perfect. We like to think that we are getting the latest information, hot from the microscope, and are prepared to tolerate the odd rough edge to the presentation. Of course, this does not mean that we scientists enjoy a poor presentation, but that we should not invest a great deal of effort once it is good enough. (İşsever and Peach 2010, p. 2; ellipsis and emphasis as in the original)

The lack of polish conveys an authenticity that is also a cognitive virtue. Too much visible effort expended in presentation, by contrast, can prompt accusations that the results are “glossy” or have been “hyped up.”

Reporting on the Golden Jubilee meeting of the Nutrition Society, Cambridge, 1991, David Southgate praised talks in which the speaker downplayed the effort that he or she had expended in the research:

> It is essential to recognize the importance of the presentation itself in interesting the audience and in arguing the case for acceptance of the ideas presented. An air of theatricality comes through from the most effective presenters; not necessarily in a flamboyant style—a studied nonchalance in presenting a key piece of evidence that required great intellectual effort in the design of the experimental work and meticulous skill to obtain it is just as, if not more, effective. (Southgate 1991, p. 353)

In all the cases analyzed in this section, conveying the impression of effortlessness in an oral presentation heightens the credibility of the material presented: it suggests that the speaker is working with the grain of the
phenomena, rather than struggling to contain a recalcitrant nature. By the same token, the impression of effortlessness raises the speaker's trustworthiness and reputation. This combination illustrates the utility of the rhetoric of effortlessness: it promotes the researcher's claim to personal credit in tandem with the credibility of results.

It should be noted that conference presentations in the humanities often adopt the rhetoric of effort, by contrast. Many scholars in the humanities read from a manuscript, rather than improvising. This practice enables them to reproduce carefully composed characterizations and arguments, and draws attention to the importance of precise wording in the contribution. This style makes it apparent that the speaker has expended effort in crafting the presentation, which is another way of enhancing the credibility of the contents.

6. Rhetoric of Effortlessness in Accounts of Past Science

As well as by scientists presenting their findings, the rhetoric of effortlessness is used by historians, biographers, and other writers commenting retrospectively on the development of science. Their use of the rhetoric of effortlessness too has the functions discussed in section 3: it buttresses the credibility of scientists' findings, enhances the reputation of individual scientists, and shapes the image of past science. In this section, I sketch how writers on two scientific figures, Isaac Newton and Carl Friedrich Gauss, have used the rhetoric of effortlessness to attain these three effects.

Implicitly, the choice between the rhetoric of effort and the rhetoric of effortlessness to describe scientists' work amounts to taking a stance in the longstanding debate whether diligence or genius is the decisive factor in the advance of science. Some historians of and commentators on science have suggested that scientists have made great contributions by means of rule-bound method, industry, and discipline, and often by working in groups. Most writers who have taken this view have found the rhetoric of effort useful. Other writers, both in Romantic natural philosophy and in today's cognitive science (Schaffer 1990; Sternberg and Davidson 1995), have argued that scientists have made great contributions by means of individual genius, inspiration or creativity. This view suggests that hard work is neither necessary nor sufficient for great science. Many writers who have taken this view have found the rhetoric of effortlessness to be a suitable expository style.

Nineteenth-century biographers and admirers of Newton engaged in such a debate about the best way to understand his achievements. One group ascribed them to genius, portraying them as the work of a moment. The other group explained them as the product of industriousness and application of
method—which some writers identified with Francis Bacon’s rules of induction (Yeo 1988, pp. 261–70; Higgitt 2007).

Those who thought that genius was responsible portrayed Newton as reaching his theory of gravitation and other contributions with little or no effort. In his 1831 biography of Newton (the first of two that he wrote), David Brewster seemed to find it unthinkable that a genius such as Newton might need any time-consuming procedure:

It would be interesting to ascertain the general character of the process by which a mind of acknowledged power actually proceeds in the path of successful inquiry. [ … ] There cannot be the slightest doubt that in its generalities at least it is the very reverse of the method of induction. The impatience of genius spurns the restraints of mechanical rules, and never will submit to the plodding drudgery of inductive discipline. (Brewster 1831, p. 336; for further discussion, see Higgitt 2007, pp. 47–9)

Biographers taking this line could draw on a number of vignettes and legends. The best-known vignette shows Newton revolutionizing physics while doing nothing more strenuous than reclining under an apple tree (Fara 2002, pp. 192–202, 216–28). This use of the rhetoric of effortlessness serves to heighten the credibility of Newton’s findings, by the same pathways we noted earlier. If the principle of universal gravitation indeed becomes apparent when one simply views the moon through the branches of a tree, rather than through extensive, detailed calculations on astronomical data, then little scope for dispute remains. Contrary to the rhetoric of effort, Brewster’s dismissal of laborious reasoning actively closes down space to doubt the result, even while it perhaps makes us despair of understanding precisely how Newton reached it.

In discussions of Newton, use of the rhetoric of effortlessness had an explicitly comparative aspect: Newton was hailed as superior to other natural philosophers on the grounds that he had easily established findings that they were able to match only with great effort. To adjudicate between Jacques Cassini’s claim that the earth was prolate and Newton’s claim that it was an oblate spheroid, the Académie royale des sciences organized an expedition to northern Sweden in 1736, led by Pierre Louis de Maupertuis, to measure the length of a degree of the meridian. The expedition members endured 16 months of privations, hard work, arctic temperatures, and mosquitoes: Maupertuis’s report, La Figure de la terre, published in 1738, was an account of herculean efforts in the service of science (Iliffe 1995; Terrall 2002, pp. 118–29). The results duly confirmed Newton’s claim. For Voltaire, however, Newton’s display of effortlessness trumped Maupertuis’s expenditure of effort. He mocked the expedition members in the poem,
“Discours en vers sur l’homme” (Voltaire added these lines in 1752: a first version had been more complimentary to Maupertuis):

Messengers of physics, Argonauts new,
Who cross mountains, who traverse waters,
Bring back from the climes ruled by the three crowns
Your poles, your sectors, and especially two Lapp women,
You have confirmed in those places full of tedium
What Newton knew without leaving home.
(Barber and Kölving 1991, pp. 494–5; my translation)

The portrayal of Newton as someone who, without moving a muscle, can predict what others will find by traveling to the ends of the earth is the epitome of effortlessness. It confirms our confidence in Newton’s findings and raises our admiration for his intellectual powers.

Other writers attributed Newton’s advances to his industriousness. Newton himself had given some credence to this view, writing that, if he had rendered any public service, it was “due to nothing but industry and a patient thought” in his first letter to Richard Bentley (Cohen 1978, p. 280). Augustus De Morgan thought that Newton had been able to make his discoveries not through genius, as Brewster maintained, but through the quite different virtue of sagacity (Theerman 1985). He contrasted the mythical “Newton of the world at large” with the real “Newton of Trinity College Cambridge,” someone who went through years of detailed calculations and false steps on the way to formulating his theory of gravitation:

The Newton of the world at large sat down under a tree, saw an apple fall, and after an intense reverie, the length of which is not stated, got up, with the theory of gravitation well planned, if not fit to print. It is painful to be obliged to add, that the Newton of Trinity College Cambridge […] not only was to a large extent indebted to the perusal of what his predecessors had written, but went through years of deduction and comparison,—abandoned his theory, on account of its non-agreement with some existing observations,—took it up again upon trial when new sets of observations had been made,—and, in point of fact, went through a detail which was a great deal more like a book-keeping operation, than the poetical process of the fable. […] The fault of discoverers generally [is that] they conceal the simple suggestions which led them on the road, and by presenting a finished and elaborate train of deduction, rather strive to provoke applause, than to facilitate imitation. (De Morgan 1837, pp. 242–3; for further discussion, see Higgitt 2007, pp. 116–26)
De Morgan, like Brewster, was a convinced Newtonian and thought that Newton’s achievements should be celebrated. However, he felt that the credibility of Newton’s findings rested on the magnitude of effort that Newton had expended, not on any paucity of effort. He inclined to the rhetoric of effort to describe Newton’s work, and found Brewster’s use of the rhetoric of effortlessness out of place.

Karl Friedrich Gauss is often portrayed as a superhuman, effortless mathematician. This reputation arose with the memorial volume that Wolfgang Sartorius von Waltershausen published a year after Gauss’s death. It enumerated instances of Gauss’s “rare mental gifts” and “ease and accuracy in mental arithmetic:” for example, the three-year-old Gauss corrected a calculation being made by his father to determine his workmen’s salaries (Sartorius von Waltershausen 1856, p. 11).

This volume is the origin of the anecdote that became the most celebrated display of effortlessness in the history of mathematics. As a schoolboy in the 1780s, Gauss calculated the sum of the first one hundred integers within a few instants, frustrating J. G. Büttner, his schoolmaster, in his attempt to keep the class occupied for an hour:

The young Gauss had just entered the arithmetic class when Büttner set the sum of an arithmetical series. The problem was barely stated before Gauss threw the slate on the table with the words spoken in the low Braunschweig dialect: “Ligget se.” [“There it lies.”] While the other pupils continued counting, multiplying, and adding, Büttner, with conscious dignity, walked back and forth, from time to time throwing a pitying and sarcastic glance toward this youngest of the pupils, who had long since finished his task. He, however, sat quietly, already penetrated by the solid unshakeable confidence that filled him until the end of his days at each completed work that his task was solved correctly, and that the result could be no different.

At the end of the hour the slates were turned over. That of the young Gauss with a single figure lay on top and when Büttner examined the answer, to the surprise of all present it was found to be correct, whereas many of the others were wrong and were immediately corrected with the leather rag. (Sartorius von Waltershausen 1856, pp. 12–13; my translation)

It is thought that Gauss used pairwise addition of terms from opposite ends of the series. The anecdote portrays Gauss as able to solve the problem with little effort by virtue both of choosing an economical path and of having exceptional talent for mathematics. In turn, both these factors raise the credibility of the result. The economical formula that Gauss used was
less liable to error than summing a hundred integers one by one, whereas
the claim that Gauss was especially talented suggested that he was unlikely
to make any mistakes. Learning that Gauss had expended more effort would
not raise our confidence: to the contrary, it would give us less reason both to
think highly of Gauss and to trust his result.

As Brian Hayes (2006) records, writers have retold this anecdote in at
least 70 biographies of Gauss, histories of mathematics, and other publi-
cations over the past 150 years, cementing the reputation of Gauss as an
effortless mathematician.

As with Newton, writers on Gauss have used the rhetoric of effortless-
ness with comparative intent, to elevate Gauss above other eminent math-
ematicians. They have done this by suggesting that Gauss was able to
establish results with less effort than other mathematicians, partly through
choosing a better route and partly through superior talent. For example,
Florian Cajori suggested that Gauss surpassed Leonhard Euler, as his solu-
tion of a problem set by the Académie des sciences showed:

In 1735 the solving of an astronomical problem, proposed by the
Academy, for which several eminent mathematicians had demanded
some months’ time, was achieved in three days by Euler with
aid of improved methods of his own. But the effort threw him into
a fever and deprived him of the use of his right eye. With still superior
methods this same problem was solved later by the illustrious Gauss
in one hour! (Cajori 1894, p. 248).

The literature on Newton and Gauss illustrates the functions of the rhetoric
of effortlessness in the hands of historians of and commentators on past
science.

7. Conclusions
I claim to have identified a previously unrecognized rhetorical strategy in
discourse about science. Scientists use this strategy to heighten the credi-
bility of findings while they present them to colleagues, students, and the
wider public; they use this strategy simultaneously to raise their own rep-
utation. Scientists, historians of science, and other commentators on science
also use the strategy to propagate an appealing image of science. This strat-
egy is the rhetoric of effortlessness, which consists in conveying the impres-
sion that, while a certain scientist was responsible for a particular finding,
establishing that finding cost him or her little effort. The strategy is perva-
sive and influential, contributing strongly to shaping how scientists present
and support their findings and how we think about science.

The distinctive feature of the rhetoric of effortlessness is that it offers
scientists a way of raising both the credibility of findings and their own
personal claim to merit for having established those findings: their ability to establish the findings with little effort reflects well on both them and the findings. In this respect, this rhetorical strategy is superior to the better-known rhetoric of self-effacement, in which the claim to objectivity of the findings undermines the scientists’ claim to personal merit.

We need further work to elucidate why and how the rhetoric of effortlessness retains its effectiveness in an era in which science is a professional activity carried out by trained experts, and in which the notion of scientific genius has lost favor. We also lack an understanding of the gender and other power dimensions of the rhetoric of effortlessness: is this rhetorical strategy equally effective for scientists with a marginal status, who are required to prove themselves as legitimate members of the scientific community? Or can only established figures claim that their scientific findings are based on something other than hard work?

References


