CAN PERSONALITY UNDERPIN ATTITUDES TO BOTH SCIENCE AND RELIGION?

by Geoffrey Cantor

Abstract. Drawing on Peter Harrison's argument that individuals should be attributed a central role in analyses of the relationship between science and religion, this article proposes that an understanding of personality can help us better appreciate a person's attitudes to both science and religion. Rather than seeing an individual's attitudes to these two topics as separate, if sometimes overlapping, parts of their lives, it is suggested that both may result from psychological drives and sometimes from the same psychological drive. Two contrasting case studies are employed to illustrate this proposal. First, Paul Dirac who, it is argued, was on the autistic spectrum, a personality profile that is often linked to both mathematical physics and atheism. By contrast, Michael Faraday's scientific practice and his commitment to a specific form of Christianity were underpinned by his need for security, as assured by the God-given laws that operated in both the physical and moral domains.

Keywords: Paul Dirac; Michael Faraday; historiography; personality; psychological perspectives

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This article seeks to extend an argument articulated by Peter Harrison (2006), by appealing to the notion of personality in order to develop one specific mode of understanding science–religion interrelationships. In his frequently cited paper on the historiography of science and religion, Harrison stressed the need to appreciate "the personal dimensions of both scientific and religious activities" and suggested that apparently "abstract discussions of theology and science"—and indeed the relationship between them—should be understood as "personal statements" that are predicated on the writer's specific conceptions of both science and religion. Harrison proposed that the study of science and religion should therefore be grounded in "historical studies" in which "the human element . . . is fundamental to both scientific and religious activities" (Harrison 2006, 105).

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 ISSN 0591-2385

If I understand Harrison correctly, he is suggesting that the study of biography should be central to the academic field we know as science and religion. Such a biographical approach would focus on how an individual conceptualized and engaged with both *science* and *religion*, as that person understood both of these activities.

Harrison's proposal thus directs our attention to the development of an individual's understanding of both scientific and religious issues. Experience and knowledge are of course relevant in both cases. However, while our mental life draws on both knowledge and experience, what matters is how an individual internalizes and deploys the knowledge and experience gained. As I will be discussing individuals, I will focus on what, for want of a better term, I shall call their personalities.[1] The Oxford English Dictionary defines personality as "The quality or collection of qualities which makes a person a distinctive individual; the distinctive personal or individual character of a person, esp. of a marked or unusual kind."[2] This is rather vague and leaves open how we are to understand the qualities possessed by persons. Rather more helpful is a definition widely used in the field of personality psychology which defines personality as "an individual's characteristic patterns of thought, emotion, and behavior, together with the psychological mechanisms – hidden or not – behind those patterns." However, there are many different types of patterns (and underlying mechanisms) that can be evoked, including those associated with social roles, such as being a scientist, or with the possession of certain abilities, such as being artistic (Saucier 2009). The following discussion draws principally on a psychodynamic approach that seeks to identify the drives or forces – both conscious and unconscious – that shape personality. While this approach has often been deployed in studying those who manifest some clinically diagnosed disorder, it can also be applied to those who are conventionally deemed normal, as in the second example below.

In the light of the above reflections on the nature of personality, this article is a response to Harrison's call to study "the personal dimensions of both scientific and religious activities" by evoking personality as the central theme in exploring an individual's thoughts, emotions, and behavior, a theme that underpins that person's views on both science and religion. In other words, the personality can be used as the link – often a common source – between that individual's engagements with the scientific and with the religious. Three points of clarification need to be made at the outset. The first is that personality, as understood here, is not fixed from birth. Instead, it is influenced by experience and can thus develop and change throughout a lifetime, although in some cases the change may be small after the onset of adulthood. The second point is that the personality is not an independent, stand-alone entity; instead, it both affects and is affected by a subject's experiences, including her experiences of both science and religion. Finally, although both of the following case studies illustrate how attitudes

to both science and religion may spring from the same psychological drive, the relationship may be far more complex in other instances.

The next two sections of this article show how the notion of personality can be used to illuminate two historical examples. The first is an eminent twentieth-century scientist, Paul Dirac (1902–1984), who largely eschewed religion and practiced an extreme version of mathematical physics. Dirac's views are then contrasted with those of Michael Faraday (1791–1867), the nineteenth-century scientist—more correctly, natural philosopher—who was a devout Christian, albeit of a rather unusual variety.

Paul Dirac

Through their researches Simon Baron-Cohen and his colleagues at the University of Cambridge have found that scientists are more likely to manifest high functioning autism (HFA, or Asperger's Syndrome (AS)) than are nonscientists. Moreover, HFA/AS is particularly prevalent among physical scientists, computer scientists, engineers, and especially mathematicians (Baron-Cohen et al. 2001). Another survey of almost half a million respondents showed that those who pursued careers in STEM subjects (i.e., science, technology, engineering, and mathematics) had higher mean scores (21.92) on the AQ (Autism-Spectrum Quotient) scale than those not pursuing careers in STEM subjects (18.95). A significant gender difference was also noted, leading the authors of that study to conclude that "being male and being in a STEM career increase the odds of being in the high-risk category" (Ruzich et al. 2015). Research on a cohort of Cambridge undergraduates likewise found a "three- to sevenfold increase for autism spectrum conditions among the mathematicians," compared with nonmathematicians (Baron-Cohen et al. 2007). Since people with HFA/AS possess a strong need to systematize their experiences and avoid being disturbed by chaotic events, they are often attracted to science, which seeks and values regularities in the natural world.[3] As Baron-Cohen has commented, "the systemizing drive in AS is often a drive to identify the *underlying structure* in the world" (2004, 149). Since mathematics is the language used to describe the world's underlying structure, those with HFA/AS find it particularly appealing. Moreover, the world of numbers is safe, and often congenial, in contrast to social interactions, which those with HFA/AS find particularly challenging and therefore seek to avoid as far as possible. Reflecting on the career of Richard Bochards, a Cambridge mathematician with HFA/AS, Baron-Cohen noted that "His talents in mathematics have resulted in his finding a niche where he can excel (to put it mildly), and where his social oddness is tolerated" (2004, 163). While the majority of mathematicians, physicists, and engineers are not autistic, these disciplines are particularly appealing to those who are at the high functioning end of the autistic spectrum.[4]

Our first subject is Paul Dirac, who strongly displayed autistic traits that were not a barrier but instead provided a stimulus to him in pursuing a career in mathematical physics. He made impressive contributions to quantum mechanics, even having an important equation named after him, and held the highly prestigious Lucasian Professorship of Mathematics at Cambridge—Newton's Chair—from 1932 to 1969. As will be argued below, his autism also provides a potential explanation of his attitudes toward religion.

The title of Graham Farmelo's (2009) biography of Dirac—*The Strangest Man*—immediately draws attention to his subject's unusual personality. Farmelo concluded that Dirac displayed to some degree all the behavioral characteristics of autism; viz, "reticence, passivity, aloofness, literal-mindedness, rigid patterns of activity, physical ineptitude, self-centeredness and, above all, a narrow range of interests and a marked inability to empathize with other human beings" (422). Farmelo illustrated many of these traits by Dirac's strange behavior. For example, his contemporaries at Cambridge were struck by his reticence and noted his tendency to answer almost any question with a single word—"yes" or "no"—and his inability to elaborate further. A lack of empathy was displayed by such responses as his dismissal of another Cambridge physicist's long-running research project with the taunt: "You ought to tackle fundamental problems, not peripheral ones" (89). While Farmelo provides much evidence of Dirac's social limitations, he also makes the crucially important point that Dirac's autism was the source of his compulsive interest and success in mathematical physics, in particular "his ability to order information about mathematics and physics in a systematic way, [and also by] his visual imagination, his self-centeredness, his concentration and determination" (425). He thrived in the world of mathematics and, to repeat Baron-Cohen's characterization of many of those with HFA/AS, he was psychologically driven "to identify the *underlying structure* in the world." By cultivating the realm of mathematical physics (including quantum statistics), Dirac was able to retreat from the chaotic and threatening world of human intercourse. Moreover, he found his niche in the Mathematics Faculty at the University of Cambridge where, as Baron-Cohen has suggested, "his eccentricity would have been tolerated and his skills valued. College life provided him with a regular daily routine and everything he needed" (424).

While Dirac's behavior aligns him with the principal characteristics of HFA/AS, his developmental history would seem to have reinforced some of his autistic traits, such as his pronounced reticence. Dirac's father, Charles, was a Swiss Catholic who taught French at a school in Bristol. He was also a tyrant who bullied his wife and children. Many years later, Dirac informed a friend about his father's stranglehold on the rest of the family. He claimed that his older brother, Felix, committed suicide at the age of 24 because their father "bullied him and frustrated his ambitions [to become

a doctor] at every turn." Likewise, his mother, Florence, who was from a Methodist background, was thoroughly dominated by her husband. Dirac particularly remembered the many agonizing meals alone with his father who insisted that they speak only French. If he made any linguistic errors, his father chastised him mercilessly. This treatment, he later acknowledged, caused him "terrible distress" and may have been responsible for his long-term digestive problems. It would also appear to have affected his ability to socialize and speak easily with others. He and his siblings—he also had a sister—were not permitted any social life outside the family and they spent most of the time indoors. "I never knew love or affection when I was a child," Dirac later admitted (Farmelo 2009, 5–6). As autism covers a range of conditions that have some genetic basis, it is likely that Dirac's "strangeness" was due at least in part to genetic factors (Yoo 2015). Yet, his tragically unhappy childhood would seem to have reinforced some of his autistic traits.

Turning to issues of religion, the authors of a recent survey found that while some people with HFA did manifest religious commitments, "individuals with HFA have a higher rate than neurotypicals of endorsing atheism and agnosticism. HFA individuals thus resemble another group of high-systemizers (scientists), who also reject religious belief at a relatively high rate." Moreover, as this study concluded, those with high autism quotients (AQs) were more likely to be atheists or agnostics, when compared with the lower AQ scores of those who tended to adhere to a particular religion (Caldwell-Harris et al. 2011). Other studies have sought to determine whether believers and atheists differ in respect to such traits as the ability to empathize and to think analytically, and those traits associated with autism. For example, one detailed study of the cognitive profiles of a large sample of religious believers and nonbelievers in Finland found that "empathizing was positively correlated with religiosity," thus supporting the view that the ability to understand other people's minds is a significant factor in accounting for religiosity (Lindeman and Lipsanen 2016, 189). But this Finnish study also showed that good empathy skills were not shared by all believers and were also possessed by many atheists. Moreover, the diversity within both groups was considerable. To analyze their results more thoroughly, the authors divided both the believers and the nonbelievers into five subpopulations in order to enable a closer analysis of these smaller and more homogeneous populations. One subgroup of nonbelievers was found to manifest marked characteristics; they had the lowest empathy factor, scored highest on mechanistic cognition, and possessed the most prevalent autistic traits of all 10 subgroups. Their score on analytical thinking was among the highest. This subgroup also included the lowest proportion of females (189–90). Thus, while it would be unhelpful to look for a single overall profile for nonbelievers, it appears that there exists a pool of people with significant autistic traits (and low empathizing

ability) who are very likely to be atheists. Such people are highly likely to consider religion meaningless, as it is beyond their cognitive reach. They are unlikely to be able to entertain a relationship with God—just as they experience great difficulties with social relationships.

The example of Dirac exemplifies just this *weltanschauung*. One of the main sources for Dirac's views on religion is a report by Werner Heisenberg of discussions that took place between Dirac, Wolfgang Pauli, and others at the 1927 Solvay Conference, one of a series of conferences that attracted the world's leading physicists. According to Heisenberg, Dirac stated:

> I don't know why we are talking about religion. If we are honest—and scientists have to be—we must admit that religion is a jumble of false assertions, with no basis in reality. The very idea of God is a product of the human imagination. It is quite understandable why primitive people, who were so much more exposed to the overpowering forces of nature than we are today, should have personified these forces in fear and trembling. But nowadays, when we understand so many natural processes, we have no need for such solutions. I can't for the life of me see how the postulate of an Almighty God helps us in any way. (Heisenberg 2007, 217)

Thus for Dirac religion had no legitimate role in modern, progressive, science-based society. Although it might play a role in primitive societies, it was now a relic of the past and the only reason why it was still to be found in modern societies was that it aided the social control of the lower classes. Echoing Karl Marx's famous dictum (McLellan 1977, 64), Dirac considered that religion was "a kind of opium" of the people. The opposition between religion and science also found expression in his view of miracles. According to one of his friends, "Dirac was especially critical of Catholicism [his father's religion] and other religions that acknowledged miracles, because, in his view, the existence of a miracle implies a temporary breaking of the laws of nature, whose beauty he regarded as sacred" (Farmelo 2009, 402).

The notion of God made no sense to Dirac. As Pauli is said to have quipped at the Solvay Conference, "Well, our friend Dirac, too, has a religion, and its guiding principle is: 'There is no God and Dirac is His prophet'" (Heisenberg 2007, 219). Advances in rationality and in science had, for Dirac, completely excluded such unfounded beliefs. Thus, in a talk he delivered in June 1971 he posed the question of God's existence, which he treated as if it were a scientific hypothesis. As confirmatory evidence was lacking, he argued that this hypothesis was unproven.[5] Although he left open the possibility that such evidence might be found at some future time, he implicitly assumed that it would never be forthcoming. This specious "scientific" test of God's existence would seem to have been a rhetorical maneuver in support of his atheistic philosophy. In some notes written in 1933 he even suggested that the existence of God could not be brought before the bar of science since this notion "is so vague and ill-defined . . .

that it is hard to discuss with any rigor" (Farmelo 2009, 221). Like many autistic people, he could not abide vagueness and a lack of conceptual clarity.

Dirac's occasional comments on religion direct us to two further issues. The first is that there appears to be a connection between Dirac's lack of empathy for humans and his lack of empathy for God. In both cases, he manifested a dearth of insight into other beings; moreover, he could not envisage a divine being. Not only did he reject a personal God but it made absolutely no sense to him to evoke the Christian notion of God underpinning the laws of nature. Instead, as Farmelo has emphasized, Dirac saw beauty in the equations of modern science. Thus, in an article published in the *Scientific American* in 1963, Dirac he asserted that "It seems to be one of the fundamental features of nature that fundamental physical laws are described in terms of a mathematical theory of great beauty and power, needing quite a high standard of mathematics for one to understand it." Reflecting the hiatus he saw between experimentalists and mathematical physicists (like himself), he even claimed that "it is more important to have beauty in one's equations than to have them fit experiment."[6] At one point in his argument, he added tantalizingly: "One could perhaps describe the situation by saying that God is a mathematician of a very high order, and He used very advanced mathematics in constructing the universe" (Dirac 1963, 53). The equivocation at the start of this last sentence indicates that Dirac was hesitant about using the word *God*. His meaning becomes clearer if we set this passage in context; in the next sentence, he contrasted this God-like perspective of the mathematical structure of the universe with "Our feeble attempts at mathematics enable us to understand a bit of the universe" (53). His evocation of *God* was, as it were, little more than an appeal to the complete mathematical structure of the universe, of which mathematicians can only gain a partial glimpse. This restricted form of the argument from design would probably be acceptable to many people with HFA, as it is primarily an affirmation of the regular, mathematical structure of the world.

According to the physicist John R. Albright, who knew the elderly Dirac at Florida State University, Dirac "was not an atheist, but rather an agnostic, who did not know whether God exists because he could not prove it one way or another."[7] This is in line with the evidence presented above, which suggests that by the 1960s Dirac became more inclined toward agnosticism.[8] Farmelo (402) has detected an undeveloped form of pantheism in some of Dirac's writings, while John Polkinghorne notes that in his appeal to the beauty of the world's mathematical structure, Dirac was evoking a form of design argument (Polkinghorne 2013, 454–55). However, it is clear from the texts quoted above that he eschewed the God of Christianity and any personal relationship with God, however, conceptualized.

The other significant issue is more closely linked to Dirac's politics. According to Heisenberg's account, Dirac considered that Church and state were working together to subdue the populace: to keep them in their place and to prevent them from rising in rebellion. There is more than a passing similarity between the repressive authoritarianism of his own father and the social control that Dirac accused the state of exercising through religion. His memory of childhood dominated by a cruel, controlling, and unloving father may have predisposed him, as an adult, to reject what he saw as the repressive paternalism provided by religion, which restrained people and prevented them from developing their own lives. By contrast, rationality and science were the progressive, open, and egalitarian tools that enabled him to break away from his authoritarian father. Similarly, humankind had to reject what Dirac saw as the repressive influence of religion.

What emerges strongly from Dirac's biography is how his personality, which was shaped by his autism and by his repressive childhood, impelled him to encompass a world dominated by mathematics and to reject—even abhor—religion.

Michael Faraday

In contrast to Dirac, Michael Faraday was a committed Christian. He grew up in London and, like his parents, regularly attended the meeting house of a small dissenting sect known as the Sandemanians or (in Scotland) the Glasites. In June 1821, he married a fellow Sandemanian and, a month later, made his profession of faith, which marked his admission to the Sandemanian church. He subsequently served as a deacon and then as an elder in the church, both positions requiring him to perform specific duties as stipulated in the New Testament. Thus, his religious commitments extended far beyond the attendance at Sunday services. Rather, in making his profession of faith he committed himself to live in accordance with the precepts laid down in the Bible and in imitation of Christ's exemplary conduct. His religion—a demanding form based on early Christian practices—was central to his identity and affected all aspects of his life (Cantor 1991).

Faraday practiced his science in close accord with his religious commitments. The physical world was, for him, God's creation and thus "the book of nature, which we have to read, is written by the finger of God" (Faraday 1859, 471). Moreover, God not only created matter but also imposed on matter the laws that determine its behavior. As Faraday stated in a document of 1844, "God has been pleased to work in his material creation by laws" (Levere 1968, 105). Thus, Faraday considered that the objective of the *natural philosopher*—the term he preferred to the more utilitarian *scientist*—was to seek the laws that were "established from the beginning" (Faraday 1846, 523). Among his foremost accomplishments was the

discovery of several such laws, including the law of electromagnetic induction and his two laws of electrolysis. In order to discover these laws, Faraday made a close empirical study of natural phenomena and executed numerous delicate experiments. In performing these experiments, he saw himself as engaging directly with God's Creation. Owing to his successes as a discoverer, he became widely acknowledged as one of the most accomplished experimentalists of his time.

The contrasts between Dirac's and Faraday's views of nature and of the role of the scientist are instructive. While Dirac described the (ostensible) designer of the natural world as a highly accomplished mathematician, Faraday rejected the view that mathematics was the language of nature; nor was it, for him, the language of God. Instead, through experiment he engaged nature directly and considered that only the experimentalist—not the mathematician—is able to study the natural world and thereby make discoveries (Cantor 1991, 215–20). Through a close engagement with nature the experimentalist could make observations of natural phenomena that provide the basic data on which science is constructed. From a series of judiciously selected experiments the scientist should try to ascertain the God-given laws of nature. By contrast, Dirac insisted that, as nature was written in mathematical characters, only the mathematician can decipher the structure of the physical world. Dirac inhabited a realm of mathematical abstraction far removed from Faraday's hands-on involvement with fragments of God's Creation.

The contrasting views articulated by Dirac and Faraday of their relationships with nature map onto significant differences in their personalities. The autistic Dirac experienced difficulty communicating with others (especially outside the realm of mathematics), held nature at bay, and, in his science, engaged the physical world through the abstract language of mathematics. Science was for him an intellectual activity that did not require him to engage directly with observable phenomena. Faraday, by contrast, possessed very good social skills and displayed considerable empathy toward others. He was widely liked and respected both in the scientific community and by those who attended his lectures. For example, John Tyndall, his colleague at the Royal Institution, not only praised Faraday's "great achievements," but also "his humility, . . . the absence of all assumption of impatience, . . . and all trace of egotism . . . ; when I think of all this[,] Faraday's character is to me incomparable."[9] Likewise, Faraday's principal biographer noted that one of his foremost qualities was "his kindness (*agapê*). It was born in him, and by his careful culture it grew up to be a rule of his life; kindness to every one, always—in thought, in word and in deed" (Jones 1870, 2, 484–85). Similarly, Faraday adopted an intimate relationship with nature, which manifested the will of its Creator. One of his most famous experiments symbolized this intimacy with the Creation. In December 1835, he sought to determine the electrostatic charge inside

a charged hollow metal container. To do this, he built a 12-foot cube surrounded by copper wire. To find the charge inside this apparatus—which became known as the Faraday cage—he "went inside the cube and lived in it," taking with him a device for measuring the strength of the electromagnetic field. In this experiment, he was immersed in a capsule located in the Earth's electric field and became part of the space under investigation (Gooding 1985, 127).

While the physical world was under the control of divinely ordained natural laws, Faraday turned to the Bible for the moral laws that God had given to humans and which he himself—as a Sandemanian—had vowed to obey. Laws (albeit rather different in their application) thus underpinned both his scientific practice and his daily actions as a Sandemanian Christian. Not only were both types of law of divine origin but their common source guaranteed the stability of both the physical and moral realms. This stability was of considerable psychological importance to him. He felt safe in a divinely created and well-ordered universe. Among the particularly safe spaces were the Sandemanian meeting house, his laboratory, and the private apartment which he shared with Sarah, his wife, in the Royal Institution (Forgan 1985).

Faraday shared his Sandemanian faith with the other members of this select sect, which required him to separate himself "from the communion and worship of all such religious societies as appear in their public doctrine and practice to be setting aside or treating with indifference the plain command of Christ and His apostles" (Anon. 1908, 18). Hence, for example, he did not attend the funerals or memorial services for his non-Sandemanian friends and acquaintances. Although he had many close friendships with fellow scientists and others, there was an unbridgeable gulf between him and them on religious and related moral issues. This separation created a sharp boundary between the Sandemanian worldview and that held by outsiders. It was sometimes very stressful for him to engage with threatening aspects of the non-Sandemanian world and he tried to avoid such encounters as far as possible. In particular, his sense of psychological security was severely challenged in contexts where order had broken down and confusion reigned; indeed, he frequently portrayed order and confusion as irreconcilable opposites that were connected, respectively, to intense feelings of security and of danger.

One example of his fear of confusion was his abhorrence of revolutionary politics, which represented for him the breakdown of the social order and the rule of chaos. Thus in a Commonplace Book, written in his late twenties, Faraday transposed the word "Revolution" into "to love ruin" and the phrase "Radical Reform" into "Rare Mad Frolic."[10] Another threat to his mental security occurred in 1864 when he was invited to become President of the Royal Institution, the institution he had served loyally for some forty years. In contrast to his role as a researcher and lecturer,

the position of president would have thrust him into the chaotic and morally suspect social world. Recognizing the extreme distress he felt, Sarah wrote to one of the advocates of this (unwelcome) honor: "My poor husband has been so troubled ... with the thoughts of the *Presidency*, that it has quite affected his health."[11] Likewise, with advancing age he frequently complained of giddiness and memory loss that added to his sense of turmoil. For example, when writing to a long-standing friend in 1860, he avowed how deeply the failure of his memory affected him: "When I try to write of science it comes back to me in confusion; I do not remember the order of things; or even the facts themselves."[12] Loss of memory was an increasing source of mental torment to Faraday.

One of Faraday's greatest fears was that he would be excluded from the Sandemanian church—a not infrequent outcome of disagreements among its members—and thus be debarred from his spiritual sanctuary. As Sandemanians considered truth to be unitary, they excluded any member who expressed religious views at variance with the consensus within the community. While that person could be readmitted to the sect, subject to admission of errors, a second exclusion was final, and no readmission was possible. A disagreement among the London Sandemanians in 1844 resulted in Faraday being excluded, a judgment that "brought me low in health & spirits."[13] Although he was soon readmitted, he subsequently felt highly vulnerable because he now faced the risk of a second, and final, exclusion. That scenario became a realistic possibility in 1850 owing to another internal dispute. Faraday's psychological anguish was recorded by Sarah in a letter written to an Edinburgh friend at three o'clock one morning: "My beloved husband[']s mind has been much disturbed in the view the Church takes of not receiving an excommunicant more than once."[14] The Edinburgh friend soon replied with advice that he hoped would enable Faraday to resolve the issue. However, as Sarah noted a few days later, he was still in a highly distressed state: "My fear now is that his mind is quite over Taxed & he seems almost as if reason would fail. The subject has pressed with such intense weight upon a brain already worn with much study & he again & again says 'I may not be a hypocrite'."[15] In calling himself a hypocrite, Faraday expressed his deep anxiety that he had abandoned truth and become deluded—a chaotic state of being, that was condemned in a number of biblical passages, such as Matthew 7:3–5 and 15:8–9. However, he slowly managed to regain his mental stability and the sanctuary of his church, which provided him with the protection he needed for the rest of his life.

Of the many psychological theories of religion, probably the most appropriate in the present context is John Bowlby's attachment theory (Bowlby 1969–80), since it addresses issues of security and insecurity. Following his early work on maternal deprivation, Bowlby made a close study of the psychological bond between infant and mother figure and argued that

the effectiveness of this bond influenced the infant's mental state and, in particular, the infant's sense of security or insecurity. While attachment theory has exerted considerable influence on the field of child development, subsequent work has extended its scope to other areas, including adult relationships, such as couples who form romantic partnerships (e.g., Hazen and Shaver 1987). Moreover, some writers have deployed attachment theory to explain the relationship between a religious believer and a figure of attachment, such as God or a saint. For example, Lee Kirkpatrick, a psychologist at the College of William and Mary (in Virginia), has argued that "the availability and responsiveness of an attachment figure, who serves alternately as a haven and as a secure base, separation from whom would cause considerable distress, is a fundamental dynamic underlying Christianity and many other theistic religions" (Kirkpatrick 1992, 6). This dynamic would seem to apply to Faraday's relationship with his God and with Christ.

The Sandemanians required members to live according to God's *Word* and to follow the example of Christ. In making his own profession of faith, Faraday committed himself to encompass this form of Christianity. He would have accepted that "all the spiritual knowledge which can possibly be acquired is contained in His revealed Word" (Anon. 1908, 4). God was the ultimate attachment figure, being the author of the Bible, which provided Faraday with the rules for correct behavior, especially in his intercourse with others. Moreover, Faraday was assured that the physical world was stable, law-like, and intelligible because it had been created by God according to His plan.

While God was the ultimate attachment figure, Sandemanians viewed Christ as the paradigm Christian, whose example they sought to emulate in their daily lives. They insisted that "*Jesus is the Christ*, *the Son of the living God*, and, as such, the only *Prophet*, *Priest*, and *King* of God's Church." Sandemanians were therefore "bound to do whatever He has commanded, as he is the *King* and Head of the Church" (Anon. 1908, 4). Christ thus played the role of a second attachment figure whose thoughts and actions Faraday sought to imitate closely in his own activities and in his intercourse with others.

Thus, both his science and the highly prescriptive form of Christianity that he embraced performed similar functions in providing Faraday with psychological stability and security based on God's works and His word and embodied in Christ's example. Moreover, both his science and his religion helped dispel the profound fear of chaos and instability that appears to have haunted him.[16]

Reflections

The above examples draw attention to the psychological drives that were formative in the attitudes of Dirac and Faraday to both science and religion.

Dirac's autism was not only a source of his atheism but also the impetus for his research into the mathematical structure of the physical universe. By contrast, Faraday's engagement with both science and religion sprang from a similar psychological drive; his need to live in a divinely ordered world and to avoid the destructive forces of error and confusion. While an extensive literature exists on the links between science and religion—for example, they may possess a shared metaphysics—the above case studies indicate how a psychological perspective can identify a common source for an individual's attitude to both science and religion.

The mode of analysis offered here is only possible if there is adequate biographical information about a subject's engagement with both science and religion. It is also helpful to be in possession of a fairly detailed and reliable account of the person's upbringing and other aspects of his or her life. Correspondence with others can also provide useful evidence. As this analysis focuses on the inner lives of individuals, there is no presumption that any particular case is generalizable to a group; for example, clearly not all people with HFA/AS become mathematical physicists nor do they all embrace atheism. Yet, as argued above, a small proportion of people with HFA/AS are strongly drawn to mathematics and to the sciences. Among these many find religion nonsensical and thus subscribe to atheism or agnosticism.

There is necessarily a speculative element in the accounts of Dirac and Faraday developed above, especially in identifying the psychological drives that account for their behavior. In seeking such drives, the historian should, of course, draw judiciously on the psychological literature. Although this article has focused on Dirac and Faraday, both of whom held strong but very different views on both religion and science, the type of analysis employed here is potentially applicable to other—potentially all—individuals.

Acknowledgments

For their generous assistance with various aspects of this paper I am very pleased to acknowledge John R. Albright, Anne Alvarez, Catherine Caldwell-Harris, Barbara Cantor, Thomas Coleman, Willem Drees, Chris Kenny, Russell McCormmach, and an anonymous reviewer.

Notes

1. In this I am following the historian of science Russell McCormmach (2014), who has studied the personality of the eighteenth-century natural philosopher Henry Cavendish.
2. *Oxford English Dictionary*, accessed online January 10, 2018.
3. There are also many other relevant studies, such as Iuculamo (2014), which show that children with autistic spectrum disorder display superior ability at mathematical problem-solving.
4. While Oliver Sachs (2001) has cited Henry Cavendish as a highly creative person with Asperger's Syndrome, he has rightly cautioned against too readily attributing the same diagnosis to other creative scientists, such as Newton and Einstein.

5. P. A. M. Dirac, "Fundamental Problems in Physics," Lecture given at 21st Lindau Meeting, June 28–July 2, 1971, quoted in Farmelo (2009, 401–02).
6. In an earlier paper, Dirac had argued that although mathematical beauty "cannot be defined . . . people who study mathematics have no difficulty appreciating [it]" (1940, 123).
7. Personal communication from John R. Albright (received August 3, 2018), which he has generously permitted me to quote in this article. He also notes that in his advanced years Dirac did not seem odd to him, which I take to mean Dirac's interactions with others did not mark him out as peculiar. Like Richard Bochards (Baron-Cohen 2004, 163), Dirac would have found the company of physicists, who principally discuss the problems of physics, far less challenging than other social contexts. Moreover, autistic people often learn situation-dependent, behavioral coping strategies that enable them to engage with others so they can thus appear less strange.
8. Dirac was elected to the Pontifical Academy of Sciences in 1961, which suggests that his opposition to Catholicism may have softened by then. Perhaps surprisingly, a memorial plaque commemorating Dirac was unveiled in Westminster Abbey in 1995.
9. John Tyndall to Hector Tyndale, July 27, 1855, in Brock and Cantor (2018, 147–51).
10. Faraday's Commonplace Book, ff. 391, 404, and 434: Institution of Engineering and Technology, Faraday Papers, SC MSS 2/1/4.
11. Sarah Faraday to Henry Bence Jones, May 31, 1864, in James (1991–2012), 6:397–98.
12. Michael Faraday to Christian Friedrich Schoenbein, March 27, 1860, in James (1991–2012), 5:663.
13. Michael Faraday to Christian Friedrich Schoenbein, April 12, 1844, in James (1991–2012), 3:209–10.
14. Sarah Faraday to William Buchanan, October 31, 1850, in James (1991–2012), 4: 195–96.
15. Sarah Faraday to William Buchanan, November 3, 1850, in James (1991–2012), 4:197–98.
16. How did Faraday, who was generally a very well-balanced person, come to possess that fear? Attachment theorists would point to some problem in early childhood. However, as very little is known about Faraday's early life, we cannot even begin to answer this question.

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