What Shall We Make of Henry Margenau? A Religion-and-Science Pioneer of the Twentieth Century

NEGOTIATING THE BOUNDARIES OF SCIENCE AND RELIGION: THE CASE OF HENRY MARGENAU

by William A. Durbin

Abstract. The life of Henry Margenau (1901–1997) offers a case study in the complexity of the science-religion relation. As a physicist-philosopher at Yale University, he pursued a public program of "amalgamating religion with science." He drew upon his authority as a physicist and a tradition of philosophical idealism to advocate a "reciprocity" between the two spheres. He argued that a "new modesty" and "metaphysical attitude" among scientists created new opportunities for collaboration. At the same time, his view of faith and his sense of the religiousness of science created troubling ambiguities. In the end, Margenau embodied the ambivalent relation between science and religion while revealing the limits of renegotiating the boundaries.

Keywords: authority; boundaries; faith; humility; idealism, integration; metaphysical attitude; physicist-philosopher; probability; reciprocity; sage; seeker; social role.

In recent years historians of science have approached a consensus about science and religion. Typically they have argued for a complex relation that cannot be fairly treated in a single metaphor—whether conflict or harmony or something in between (Brooke 1996, 1990; Lindberg and

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Numbers 1986a, 1986b; Rudwick 1981). To be sure, scholars have proposed various ways to relate science and religion, often arguing for a preferred case (Barbour 1990; Haught 1995; Appleyard 1993). Nevertheless, the historical record, or at least the lessons gleaned from history, suggest a fluid situation.

Sociologists of science have tended to reinforce this impression of fluidity. Proponents of the social construction of knowledge, in particular, have described the relation between science and religion in terms of competing ideologies expressing the transfer of cultural authority (Turner 1978; Young 1973), or in terms of negotiated social contracts defining the place of science in society (Shapin 1990). From a sociological point of view, *science* and *religion* are bywords in public discourse delineating the boundaries of intellectual culture; and periodic "boundary work" entails multiple "rhetorical strategies" which can portray science and religion at war, at peace, or perhaps both (Gieryn 1983, 791–92, 1988. 589–91; Wuthnow 1985).

From this analytical perspective, historians of science and religion have moved away from overarching metaphors to offer methods to *manage* the complexity (Brooke 1991; Drees 1996). John Hedley Brooke, for example, has proposed a three-dimensional "map" for analyzing the science-religion relation. He begins by noting "levels of interaction" between religious belief and scientific theorizing. From here he observes that in the historical interplay between scientific and theological discourse, any given scholar may play a number of different roles. The natural scientist, for example, has historically acted "as investigator, as reporter, as popularizer, as philosopher and as preacher." These roles are signaled by different styles of rhetoric designed to reach different audiences. In order to sort out this complexity, Brooke, among others, has called for more case studies (Brooke 1996, 17; Cantor 1991).

The present article responds to that call. It focuses on the relatively unexamined territory of twentieth-century American science—unexamined in terms of how individual scientists and their communities have lived the conflict or sought the harmony or renegotiated the boundaries between scientific research and religious faith (see Wright 1988; Breed 1992; Numbers 1992). The aim is not to propose one model of relating science and religion over another, but to present a case study in renegotiating the social contract.

I focus on the life and thought of Henry Margenau (1901–1997), who, as Eugene Higgins Professor of Physics and Natural Philosophy at Yale University, attempted to bridge the two cultures of his day. He expressed his "fondest hope" as one of "amalgamating religion with science" (Margenau 1978, 387). In pursuing that hope, Margenau played a number of different roles—speaking variously as physicist, philosopher, popularizer, and, in some sense, pastor. In the course of his career and on into active retirement, he fairly embodied the "ambivalent border between science

and religion" (Gieryn 1988, 583). The successes and failures of his efforts suggest both the possibilities and the limits of renegotiating the boundary lines of modern intellectual culture and fashioning a postmodern settlement.

Specifying the Boundaries

The stage for this story was dramatically set in 1918. For Margenau, the year meant the return of his father from war, mourning his mother's untimely death, and an uncertain future as a schoolteacher (Margenau 1978, xiii–xv; 1985a, 55). For others of his generation, equally intent upon the intellectual life, it meant a rude awakening. The bearer of bad tidings was the venerable Max Weber, who, in his final public lecture, disabused his students of any idealistic notions about the academic life. In a controversial address delivered at the University of Munich, Weber warned his proteges that if they wished to pursue a "scientific vocation,"[1] they had better be resigned to the life of the specialist. In a disenchanted world, scholars would draw their authority from single-minded pursuit of the next fact.

"Science today," Weber declared, "is a 'vocation' conducted through *specialist* disciplines to serve the cause of reflection on the self and knowledge of relationships between facts, not a gift of grace of seers and prophets dispensing sacred values and revelations. Nor is it part of the reflections of wise men and philosophers on the *meaning* of the world." Weber told his students that specialization was "an inescapable fact of our historical situation, and we cannot avoid it, if we remain true to ourselves" (Weber [1922] 1989, 27; emphasis in original).[2] Turning aside a German educational tradition of *Bildung* and *Idealismus*, Weber separated the realms of fact and value. He insisted that in the modern world, intellectual integrity demanded a distinction between the role of the investigator and that of the sage. In forthright terms, he delineated the boundaries of an intellectual culture grounded in the moral authority of the expert.[3]

Henry Margenau was among that generation of young Germans to whom Weber spoke. Although his social class prohibited him from attending the gymnasium or university, Margenau nevertheless shared the idealism of his contemporaries.[4] Moreover, by a series of remarkable coincidences, along with natural intelligence and sheer ambition, he ultimately *did* gain admittance to the academy. In 1921, at age twenty, he left Germany for America, hoping to find work as a high school Latin teacher. He eventually became an accomplished physicist and philosopher of science, described by one colleague as "the most important philosopher of physics of his generation" (Bunge 1978, ix). As a young member of that German postwar generation, Margenau brought to America an inclination to philosophical reflection, an opposition to narrow specialization, and impetus toward the role of prophet.[5]

In pursuit of his academic vocation, Henry Margenau persistently blurred

the disciplinary boundaries of intellectual culture. He followed "philosophical cravings" beyond what he derisively called "the narrow concerns of the specialist" (Margenau 1978, xiv; 1953, 3–4). He moved from the practice of science to reflections on the meaning of that practice to a theory of knowledge and a view of reality he hoped would contribute to a "synthesis" of science and religion (Margenau 1984a, 1). At the heart of his amalgamating strategy lay the claim that science had become "distinctly more modest" in its "demands" upon religion—a view of the limits of science which, he argued, would replace the fact-value dichotomy with a new "metaphysical attitude" (Margenau 1948, 308; 1956, 32). In effect, Margenau pursued a vision of scholarship which might transform the insights of the specialist into the wisdom of the sage. The end results of his efforts proved the power of Weber's perception of the academic profession while revealing something of an ongoing demand for the wise man among the experts (see Haskell 1984; Brint 1994, 150–74).

The Physicist-Philosopher

As a research scientist, Margenau could claim competence in a number of fields. Beginning with his graduate work on the Zeeman effect, he became a recognized expert in spectroscopy. His theories of spectral analysis developed in the 1930s were still in use in the 1950s, helping the Defense Department analyze the chemical composition of hydrogen bomb explosions. He also was among the first to explore quantum effects in intermolecular forces, and he became a noted authority in this field by 1939. During World War II his work in microwave theory led to the development of two-way radar technology. In the academy, he was described in the Yale catalogue as one of two scholars who established the university's tradition of theoretical physics. As a summary of his achievements, two of his former students described Margenau as a "pioneer in the application of quantum mechanics to the study of atoms and molecules" (Cohen and Park 1992, 653). In general, it seems fair to say that Henry Margenau occupied that second tier of research scientists who contribute to the development and extension of physical theory without making the kind of creative breakthroughs that win Nobel prizes.

At the same time, the very process that made him a respectable research scientist and theoretical physicist also gained him a certain cultural status authorizing his pursuit of philosophy.[6] Like a few other, mostly European, physicists of his day, Margenau was immediately drawn to the philosophical implications of his research (Sopka 1980, 3:68). Like Einstein, he suggested that the conundrums of quantum mechanics were simply too important to leave to professional philosophers. He expressed the basic thrust of this broader vocation when, toward the end of his career, he told a Rhode Island College audience: "What needs emphasis in the West today

is the competence of science to influence philosophy and through philosophy other phases of the human spirit" (Margenau 1963, 8–9). In general terms, Margenau sought to provide a philosophy of physics that might serve to reconcile the sciences and humanities and lead to the integration of all knowledge.

In his philosophical work, Margenau followed a Kantian path. He set out to describe the conditions of thought that made scientific knowledge possible—especially in light of the revolution in scientific thinking. Like his contemporary and friend Werner Heisenberg, Margenau gave up on getting a visual fix on subatomic phenomena. He noted simply that entities too small to be seen need not have pictureable qualities. Electrons, for example, could not be said to behave like planets orbiting a nucleus in predictable paths and with determined velocities. To make sense of a decidedly *unmechanistic* state of affairs, Margenau drew upon philosophical idealism to clarify the new scientific worldview. He sought to reestablish the foundations of physics by explaining how the mind contributed to the makeup of physical reality.

From his first philosophical paper (which appeared one year after he earned his Ph.D. in physics), Margenau proposed a theory of knowledge which followed Kant's dialectical dictum: "percepts without concepts are empty; concepts without percepts are blind." Physicists, Margenau explained, "cannot gain natural data without the aid of intellectual processes and we cannot think about nature in terms completely free from reference to elementary external events." Investigation of the subatomic realm, in particular, had brought home the fact that "algebraic relations may be just as essential a component of reality as the notion of matter" (Margenau 1929, 321–23). Reflection on the give-and-take method of science led Margenau to propose a "constructionist" philosophy of science (Losee 1987, 54–56). From this standpoint, physical reality comprised both mental and material components.

Margenau used the term *construct* to stress the role of the mind in scientific understanding—in the interplay between observation and theory which constituted physical explanation. Constructs included scientific abstractions like tachyons or state vectors, but they also included things like trees and rolltop desks. That is to say, in order to avoid an ontological gap between micro and macro worlds and any disparity between scientific thinking and everyday reasoning, Margenau argued that even the "immediately given" objects of sensation required the ordering contribution of the mind to gain objectivity. The "rhapsody of perceptions," Margenau said, quoting Kant, required a "texture of reason" to gain coherence and meaning. In the method of science, "sense perceptions . . . are converted by the intellect into constructs, which make up the things of the external world." His fully developed philosophy described "rules of correspondence" and "metaphysical requirements" (like the simplicity and beauty of a theory)

that governed this process of correlating percepts and concepts. Margenau concluded that those constructs which were confirmed by prediction and further observation were "verifacts," the constituents of physical reality (Margenau 1984a, 62).

Margenau's philosophy of physics, then, proceeded from epistemology to conclusions about "the nature of physical reality." His approach fell somewhere between that of Niels Bohr (who argued that physical reality, to the extent that it could be discussed at all, was *known* reality) and that of Albert Einstein (who maintained that reality existed independent of human observation). Like Kant, Margenau aimed for a middle position between rationalism and empiricism, between the idealism of German philosophy and the realism of the practicing scientist. He viewed the prevailing Copenhagen interpretation of quantum mechanics as unsatisfactory and rejected complementarity. He argued that the electron, for example, could not be considered a particle or a wave. It was, rather, "quite different from either of these. It can only be described as a probability field" (Margenau 1984b, 39). Probability fields were an obvious though perhaps unsettling mix of the mental and material constituents; but, Margenau argued, postulating their existence rendered quantum theory complete. "Probabilities," he insisted, "are the ultimate concepts in the theory of electron behavior. And nothing else is needed to make the theory complete" (Margenau 1984a, 90). Moreover, this abstract view of physical reality had the advantage of reconciling quantum and classical mechanics. Margenau could sustain the principle of causality by noting that quantum theory dealt with the predictability of probabilities.

Encouraged by Ernst Cassirer and by F. S. C. Northrop, his mentor at Yale (see Margenau 1978, xxiii–xxvii), Margenau offered a philosophy of physics most accurately described as "phenomenalistic" (Nagel 1961, 120–29; Losee 1987, 45). He followed Edmund Husserl's transcendental phenomenology, maintaining that there was an inseparable unity between what is perceived and the perception of it. Margenau's reflections on how and what the physicist knows redefined *scientific* being-in-the-world. He rejected a Cartesian separation of mind and matter in favor of a restored connection between the thinking self and the external world. From this existential vantage point, he sought to realize his fondest hope: "a synthesis of science, philosophy, and religion" (Margenau 1984a, 1).

A Community of Scholars

Margenau's philosophy of physics was considered rather unconventional in his day, and he himself was regarded as something of a maverick in the field (McMullin 1993). While he gained recognition and praise for his contributions to the interpretation of quantum mechanics,[7] his attempts to extend this interpretation into fields of moral and religious philosophy

were regarded as "amateurish" by some (Grünbaum 1995; Weiss 1993). In the field of religion and science, he has not generally been credited with significant contributions, despite the potential of his nonpositivist approach (van Fraassen 1995; Smith 1992; McMullin 1993). These criticisms and doubts reflected the impact of specialization in solidifying the boundaries of intellectual culture, as well as certain ambiguities in Margenau's approach to integration. Both types of constraints to his pursuit of a social role beyond physics are examined further below.

In any case, Margenau persistently foreswore the "narrow concerns" of the specialist to pursue the broader implications of his method. In this pursuit, he seemed to follow not only Kant's dialectical principle in epistemology but Kant's prescription for the social role of the philosopher, namely, "to limit reason in order to leave room for faith" (see Margenau 1953, 6). With the mix of caution and audacity required of a life on the boundaries, Margenau pushed the limits of his scientific authority. He aspired to the role of physicist-philosopher. In this effort, he self-consciously identified himself with a community of scholars who themselves had presumed to draw out the metaphysical implications of their work. Specifically, Margenau associated himself with a small cadre of physicists who, he said, had responded to "the roll call on reality" and were "all religious in their beliefs" (Margenau 1984b, 43–44). It was from within this "conclave" that the physicist cautiously pursued the role of sage.

Margenau provided an early portrait of this community of scholars. In 1948, soon after he had gained full professor status in physics and won a joint appointment in philosophy, he was asked to contribute to an analysis of college textbooks. The study was part of a larger debate about the place of religion in higher education and the role of the intellectual in upholding the values of a free society (Conant 1949, 93–103; Conference on Science, Philosophy, and Religion 1940–1961; Breed 1992, 11–26). This particular study was designed to assess how religion was being treated in various disciplines (Edward W. Hazen Foundation 1948). In his contribution, Margenau examined the treatment of religion in chemistry and physics textbooks, because by that time he had established a reputation for writing such textbooks himself (Lindsay and Margenau 1936; Margenau and Murphy 1943). In his review, Margenau pointed to a new mindset among physicists which had replaced the "fact-value attitude" with an orientation more congenial to religion.

Margenau began by acknowledging the lack of religiously relevant passages in science textbooks. He attributed the "noncommittal attitude" of his colleagues to the strictures of scientific reasoning. Echoing Weber's perception of the boundaries, Margenau observed that the physicist's own work "has taught him to use language with meticulous care, and he shrinks from committing verbal errors in a foreign universe of discourse. He often has strong convictions, but he is reluctant to voice them because he cannot

adduce reasons for them which can stand in the face of the right kind of evidence to which he is accustomed" (Margenau 1948, 307). From Margenau's point of view, however, these reservations and self-imposed boundaries were now being tested, and he reserved most of his review to a discussion of a handful of texts exhibiting a countervailing "attitude."

These books were written for the nonspecialist by noted scholars whom Margenau described as "theoretically-minded investigators." Among them were prominent physicists who drew out the implications of their work for questions about God's existence, free will, and the immortality of the soul. Together these physicist-philosophers pointed to a way out of the science-religion/fact-value dichotomy. Margenau maintained that their work exhibited a "metaphysical attitude" reflective of a new modesty (Margenau 1948, 308). This new disposition involved a precarious, existential sense of the "ever-present boundaries" between science and "the unknown"—an awareness of the thin veil between thought and being, between the self and the world. The new scientist, Margenau wrote, felt "keenly that the frontier of science will never vanish, that beyond this frontier there lies forever a region, amorphous from the point of view of science and infinite in extent, which will incite scientific inquiry, retreat before it but never yield to it" (Margenau 1948, 308). In subsequent writings and lectures he would identify this amorphous realm with religion (Margenau 1956, 32).

Displaying the New Modesty

As his academic career reached a peak, therefore, Margenau signaled a strong motivation and an authoritative ground for pursuing a broader social role. In his 1948 review of books, he had laid claim to both a community and a rationale for bridging realms of discourse. He seemed to perceive the prospect of reaching both his colleagues in science and the lay public with a message of rapprochement between the "descriptive" and "normative" disciplines. Indeed, in his review, he appeared to be sifting the literature in order to formulate a legitimate religious stance of his own, a harmony of scientific and religious convictions. Following this exercise, and armed with a type of assurance it had provided, he moved further out into the public arena to perform the role of physicist-philosopher. In this public persona, he responded to a variety of requests to speak on the relation of science and religion.

How Margenau *appeared* in that role is itself intriguing. One such appearance was captured in a newspaper account of a public forum held in New York City in 1965. Here, at the Carnegie International Center outside the United Nations, Margenau spoke as research director for the Foundation for Integrated Education—an organization he had helped found in the late 1940s.[8] The foundation's humanistic goals and quasi-religious vision were expressed in the masthead of its publication, *Main Currents in*

Modern Thought, a journal which Margenau helped edit. *Main Currents* existed as "a cooperative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man and Society, assuming the universe to be one, dependable, intelligible, harmonious" (Margenau 1955a, 102). These integrative goals and this holistic vision provided an ideological framework and public role for the physicist-philosopher. The foundation offered an extracurricular and even para-church arena for the performance of a sagelike role.

At the gathering in New York City, Margenau spoke on the topic of "Science and the Recovery of Meaning." In a news story entitled "Meeting Ponders Fact vs. Wisdom," the reporter described the event as an "intimate theater-of-the-intellect." The audience of about seventy people comprised an eclectic group of lay and professional people who, in the reporter's words, had gathered for an evening of "philosophic exchange." Margenau himself came across as both a "humble scientist" and a "philosopher at work." He punctuated his remarks with "emphatic gestures" while his pipe sent "columns of smoke into the air-conditioning duct." Following his prepared remarks, he addressed audience concerns about the effects of scientific knowledge on the religious views of humanity. Sounding a theme that had by then become a trademark, Margenau offered assurances that physicists, especially, had become increasingly aware of the tenuousness of their theories, increasingly modest in their claims, and increasingly aware of their own dogmatic tendencies. At the same time, Margenau suggested that "religion" had lost some of *its* "dogmatism." As a result, the physicist-philosopher looked forward to "a convergence of interests" between science and religion based on a shared humility (Phillips 1965).

Margenau performed this social role and preached this message in various public settings, including visiting lectures at liberal arts and church-related colleges; an address before the first Star Island Conference on Religion in an Age of Science; at least two talks billed as "lay sermons," including one delivered on Sunday at Center Church in New Haven (Margenau 1955a); direct or indirect contributions to theological discussion groups involving both Protestant and Catholic theologians (Margenau 1955b, 1958; Schilling 1962, 192–96); publications with a philosophic bent, meant to fill a gap between textbook and popular accounts of the new physics (Lindsay and Margenau 1936; Margenau 1950a); more popular works in which he proposed connections between physics, ethics, and religion (Margenau [1961] 1983, 1979; Margenau and Bergamini 1964). These varied and rather unsystematic efforts continued on into his retirement. In the 1980s and 1990s, Margenau spoke in support of Christian theism even as he wrote sympathetically about the connections between physics, parapsychology, and Eastern religions (Margenau 1984a, 1984b; LeShan and Margenau 1982). Taken as a whole, Margenau's various pub-

lic performances, if you will, leave the impression of a man tactfully yet persistently negotiating the boundaries of intellectual culture.

Though hard to pin down theologically, Margenau's public discourse on science and religion did follow a typical pattern. He began his talks minimalistically, personifying the humility that informed his argument. He admitted to no "formal views" on religion and certainly no expertise in theology. Nevertheless, he had, he said, deep religious concerns which he hoped to resolve. To do so, he offered his sketch of the scientific method, taking his audience on an excursion into the scientific imagination. From this vantage point, he could give reasons for a greater tolerance and sympathy among physicists for religious worldviews. He could and did propose certain "parallels" and "areas of contact" between scientific and religious understanding. From this tentative, cautious approach Margenau recommended a reciprocity between the sciences and theology based on a shared method. He envisioned a collaborative enterprise productive of a science of religion (Margenau 1955a, 1956, 1984a).

Renegotiating the Boundaries: Reciprocity

As suggested by his appearance in New York, Margenau's public presentations required a delicate blend of scientific authority and affecting modesty. On the one hand, he acted as a spokesman for science, affirming that the "new style of science" had produced a new modesty among scientific investigators. He argued that the "novelties" of the new physics had produced a "complete refutation of the old-style materialism" (Margenau 1955a, 108). In the process, fundamental scientific assumptions about the physical world—including basic principles of causality and commitments to physical determinism—had to be rethought. "We know that present science is not the whole of science, and the surprises we have experienced in respect to novelty and strangeness of recent developments have engendered a degree of humility in our attitudes that is unprecedented in the history of scientific man" (Margenau [1961] 1983, 75). Given the apparent precariousness of scientific understanding, the physicist, especially, could readily relate to religion. "Modern science," Margenau observed, "has changed in many ways and in a manner which make religious beliefs much more tolerable than any kind of science did before" (1984b, 39). At the very least, "the conflict between science and religion has become less sharp, and the strain of science upon religion had been greatly relieved" (1956, 32).

With this newfound sympathy, the sensitive scientist could readily perceive "areas of contact" with religion. For Margenau, such contact included appreciation for divine assurances of an orderly world susceptible to scientific study. Indeed, Margenau occasionally played the role of biblical exegete to stress the point. He took some pride in uncovering a

"second story of creation" in Genesis. On a variety of occasions, he pointed out that the biblical story of the Flood and the Rainbow revealed God's creation of natural law. Drawing upon an interpretation found in the Talmud, Margenau proposed that when Jehovah promised never to destroy the world again by flood, but instead established a pattern of "seedtime and harvest, and cold and heat, and summer and winter and day and night," God had declared a new order. Gone was the time of moral and natural chaos; and the rainbow signified God's promise to forever rule by natural law. In a talk given at the New School for Social Research and in his lay sermon to the congregation at Center Church, he concluded: "If I understand this passage correctly, it means to say that the order of the universe is a divine gift. It is the gift to believe that we may bank on the stability of the occurrences in the world." From his exegesis Margenau concluded that religion had herein "granted a charter" to science. He went on to propose that since religion had acknowledged "the legitimacy of science," it would behoove science "to make an equally generous reciprocal gesture to religion" (Margenau 1955a, 108–9; 1957, 55).

For Margenau, that reciprocal gesture involved tentative proposals for a "science of religion" based on a common method of inquiry. Arguing within a tradition of empirical theology,[9] he proposed that, while modern science could more readily "adjust itself to the concerns of religion . . . the rules of scientific methodology are [also] now sufficiently wide and flexible to embrace some forms of religion within the scientific domain" (Margenau 1956, 32). If this sounded like an invasion of territory, Margenau did not seem conscious of that. Instead he appeared to be proposing a partnership, a true reciprocity. In his advisory capacity, he could, he said, offer "no detailed material aid" to theology. "Least of all does [a science of religion] require slavish adherence of theological doctrine to the constructs of physics, chemistry or biology." On the contrary, he observed that religion (understood here to involve distinct religious traditions) possessed a storehouse of its own constructs—ideas, however intangible, that made beautiful sense out of "the oppressive and brute facts of religion" (Margenau 1956, 34). The humble scientist stood by to offer advice on an effective method to interpret *religious* experiences.

Indeed, some of Margenau's most affecting passages entailed suggestions for such a theory of religion. Drawing upon a conception of religious feeling influenced by Schleiermacher, he occasionally enumerated the kinds of experiences he considered peculiarly religious. These included "the spontaneous feeling of gratitude that wells up in man's heart on a joyous day, the feeling of awe in the face of overwhelming beauty, the guiltful contrition that follows a sinful experience, the sentiments of misery and abandon at the insufficiency of human power before fate, the longing for grace and redemption" (Margenau 1955a, 110). Moreover, the life of science itself cultivated a sense of "wonder and awe" at the marvelous order

of nature as expressed in the remarkable simplicity of explanation. "If this sentiment be religious," he concluded, "science does indeed engender it" (Margenau 1978, 336, 384). The scientific investigator, imbued with the metaphysical attitude and the new modesty, could readily cooperate with the task of theology.

Margenau went further in his proposals for a theory of religion by means of a unified method and a humble attitude. He recommended that ideas drawn from scripture and religious tradition could bring a comforting order to the "brute facts" of religion. He noted, for example, that Luther's idea of *trotz*, "in spite of," represented a religious idea of redemption that, for Margenau, gave powerful meaning to the religious fact of "guilt" (Margenau 1978, 372). Moreover, on various occasions he noted a powerful "coordinating pattern" for experiences of guilt and evil and loss that emerged in the New Testament. In homiletic fashion, he pointed to Matthew 11:28 as "an organizing idea of power and simplicity." Quoting Jesus himself, Margenau observed that the words "'Come unto me, all ye that labor and are heavy laden, and I will give you rest' [offer] a religious theme of supreme satisfaction." Through such ideas, "many crude experiences make beautiful sense" (Margenau 1955a, 110). By implication, a partnership between physicist and theologian could surely advance the cause of religion in the interest of both parties.

In the end, Margenau's reciprocity called for a new modesty that blended what William James had described as the tenderhearted and the tough-minded approaches to scholarship (James [1907] 1975; Hollinger 1981, 265–66). On the one side stood exact scientists and their tough-minded demand for a precise language and "the right kind of evidence." From this vantage point, the facts of religion, like the facts of science, demanded "a texture of rational organization" to make sense. The standards of science required that any theology be "measured by the degree of rational coherence which it bestows upon these singular religious experiences that assail the sensitive mortal. And this I take it," Margenau added, "is what formalized religion or theology aims to provide" (Margenau 1955a, 110). In this process, certain accepted doctrines would have to go, failing to meet the requirements of empirical verification. Margenau himself specified deism and the doctrine of predestination as outmoded.

On the other side, the exact scientist had gained a new sensitivity—a "tenderheartedness" nurtured in the new modesty. As Margenau put it in his lay sermon, the fact that "religion's theory is replete with intangible ideas, that in the terminology of its detractors it bristles with the 'technicalities of salvation,' is small wonder to one who is familiar with the intangibles of science" (Margenau 1955a, 110). Imbued with a new sympathy, the physicist could certainly entertain a dialogue with theologians and even offer support for particular doctrines. Margenau himself argued for the credibility of creation from nothing (*creatio ex nihilo*). He frequently noted

that this classic Christian doctrine did not violate the principles of physics, at least as currently understood by physicists (Margenau 1958, 41–44; 1984b, 41–42). In general, Margenau implied that the piety of the scientist had opened up common ground with the theologian, holding out the prospect of constructing a bona fide science of religion.

The Faith Dimension

But just at the point where Margenau's fondest hope appeared realizable, the prospects for actual collaboration faded. The problems were both internal and external to his amalgamating strategy. Ambiguities in his thinking reflected certain social realities when his proposals for a unified method met resistance from professionals in other disciplines. The ambiguities suggested the difficulty of speaking for more than one constituency, and resistance suggested the limited authority of the physicist-philosopher to renegotiate cultural boundaries. Indeed, the circumspection with which Margenau pursued his mediating role indicated his awareness of the difficulties. Together the ideological and social dimensions of Margenau's consulting role implicated the limitations of his idealistic approach.

Ambiguities in Margenau's thinking appeared at the heart of his efforts to draw parallels between science and religion. He argued, for example, that *faith* operated in both realms. In science, Margenau said, the investigator relied on a deductive process of reasoning which moved from postulates or axioms to predictions about the natural world. "Postulates are matters of belief," he told a number of audiences. "Their acceptance requires more than knowledge of the facts. It requires a *commitment.*" Margenau defined scientific faith as "a kind of voluntary, reasoned commitment" to postulates, the starting points of scientific explanation. He claimed that this commitment was "logically speaking . . . of precisely the same nature as what we call *faith* in religion." Again, from within the scientific method, the physicist could identify with religious conviction, with the assurance of things hoped for, the evidence of things unseen (Margenau 1953, 10; 1957, 55; emphases in original).

At other times, however, Margenau recognized a fundamental distinction. He described a kind of commitment above and beyond the call of science. He referred to a faith necessary to transcend the horizon of inquiry and to grasp "the metaphysical substance of what assails our being in the act of sensation." In his Aquinas Lecture at Marquette University, he assured his audience that "most scientists do believe that experience points to an ontological reality beyond the physical which consists only in verifacts." Nevertheless, to apprehend this reality required an act of will beyond that required of scientific investigation. "To reach ontological reality," Margenau said, the physicist "must make a leap, a commitment of a kind transcending, I believe, those which enable him to be a scientist." True

reciprocity, it would seem, required more than mere scientific faith (Margenau 1958, 36).

Margenau contended that the "sensitive" scientist could make the leap. Following the program of transcendental idealism, he argued that the metaphysical implications of the new science could "*facilitate passage* from the field of scientific inquiry to the more amorphous domains that lie around science [which] include religion" (1956, 32; emphasis added). Still, this transcending movement appeared to necessitate an act of faith (and perhaps hope) distinct from the virtues of inquiry. At this point Margenau, having argued to the metaphysical horizon, could only propose that the investigator should admit to the limits of his method and "entrust himself to other hands" (Margenau 1958, 36). The phrase echoed, verbatim, sentiments expressed by William James and Max Planck (James [1902] 1978, 503; Margenau 1948, 17). The entreaty also reflected the pietistic sources of Margenau's thought and his particular solution to the science-religion relation. But this solution, drawn deeply from a religious tradition, dissolved in the broader public realm. As one of his former students and critics put it, to argue for the limits of reason in order to make room for faith is suspect at best (Grünbaum 1995). Unless Margenau's various audiences were prepared to follow the physicist-philosopher in a leap of faith—a move Weber regarded as "the sacrifice of the intellect"—his strategy of integration seemed to have reached an impasse (Weber [1922] 1989, 13). His solution ultimately appeared to rest on the appeal to authority—to his authority as a believing scientist.

Boundary Problems

This sense of impasse is reinforced at the social level. From Margenau's earliest efforts to bridge the disciplines, he had encountered criticism for overstepping disciplinary boundaries. His initial proposals for a science of ethics, for example, were criticized for presuming that a method appropriate to the physical sciences would work in other disciplines (Margenau 1947, 13–28; 1950b, 185–203). Later, his more fully developed "ethical science" sparked a brief public dispute. In the correspondence pages of the *New York Times Book Review*, he and another philosopher debated the value and professional standing of his proposals. His adversary, Ernest Nagel, took him to task for failing to provide a scientific basis for ethics and for ignoring the work of ethical theorists (Nagel 1964; Margenau 1965a).

In defending his views, Margenau picked up on Nagel's defense of ethical theorists. He chose to emphasize Nagel's observation that he, Margenau, "obviously believes that moral theory is everybody's business [an observation Margenau later 'militantly' reaffirmed] and that the subject is far too important to be entrusted entirely to professional philosophers or theologians." (The latter view appeared to emerge from the physicist's sense that philosophy of science was too important to leave to philosophers.) Mar-

genau defended his right, and the right of all nonexperts, to contribute to ethical reflection. He fairly bristled at the suggestion that ethics ought to be "reserved for the specialists." Quoting Nagel, he disputed the notion that "in ethics as in physics significant contributions to the subject are usually made by the professionals." Such a "separatist dogma," Margenau declared, lacked the support of both history and philosophy. Indeed, such dogmatism "warps the moral fabric of our Western culture and occasions the sterility, the anemic character of our ethical concerns." In the end, Margenau placed himself in dialogue, if not in league, with "Moses, Jesus, Buddha and Confucius." Upholding his own efforts at the boundaries of modern culture, he defended the contributions of religious prophet, sage, and teacher against what he perceived to be the suggestion that they had been "eclipsed" by professional ethicists (Margenau 1965a).

Margenau's proposals for a *science of religion* faced similar jurisdictional problems. In 1956, for example, he presented a paper to the Duodecim Theological Society—one of a variety of professional groups of the time dedicated to informal theological discussion (Warren 1993; Schilling 1962, 1973). In his paper, Margenau argued from the physical principle of "latency" in support of the doctrine of Creation. He explained how, in the act of measurement, the physicist assigns a particular value to a property of a physical system. These properties, such as mass or velocity, define the state of that system at a particular time. In modern physics the concept of "observable," developed to describe these properties, suggested the importance of the observer in defining the state of the system. In the case of a *quantum* system, it became especially clear that observables, such as the momentum or position of an electron, could not be said to be properties *possessed* by an object until a measurement was made. Until that act of measurement, Margenau explained, these properties had to be considered "latent observables" constituting a range of possibilities completely indefinite until a particular value was assigned. The divine act of creation, he went on, could be considered in analogous fashion. He proposed that *creatio ex nihilo* involved the "actualization of latent structure by divine intervention." This analogy, he said, may be "radical and heretical," but it did offer a "bridge between science and religion" (Margenau 1955b).

Presumably such bridges were what the theologians were seeking, but judging from notes of at least one participant at the meeting, they harbored doubts about the usefulness and even coherency of the physicist's proposal (Margenau 1955b). These reservations were perhaps due to the increasingly arcane nature of scientific discourse and to Margenau's particular interpretation of physics.[10] Nevertheless, prospects for reciprocity seemed to suffer as much from specialization in theology as in physics. At least some theologians, in the context of a "theological renaissance," were moving away from collaboration with scientists and philosophers (Smith 1992). To the extent that Margenau perceived himself as working within

a tradition of empirical theology, he was moving against the tide.

Yale theologian George Lindbeck indicated the nature of the problem. Lindbeck, who shared a Lutheran background with Margenau, recalled conversations he had had with Margenau when both were fellows of Silliman College at Yale. These conversations about theology and science "never got very far," Lindbeck admitted. He confessed that, although he thought Margenau was doing something important in the area of religion and science, he (Lindbeck) felt a considerable distance from that effort. While Margenau appeared to have great "respect for religion," Lindbeck said, he did not seem concerned with "the kinds of things the Christian religion has recognized as truths or our way of posing the questions." Lindbeck also believed that Margenau was not sufficiently attuned to a broader philosophical tradition, starting "from Aquinas," which attempted to render intelligible the mysteries of the faith (Lindbeck 1993).

To bridge the "impasse," Lindbeck thought that Margenau would have to appreciate Wittgenstein and study the strains of theological discourse emerging from Kierkegaard and Karl Barth. For his part, Lindbeck acknowledged that he would have to "sit in on Margenau's classes" in order to evaluate the philosophical foundations of the physicist's approach. Lindbeck conceded that neither scholar felt inclined to do these things, suggesting certain practical barriers to reciprocity. Moreover, Lindbeck seemed unconcerned with finding a universal method for theology or a universal language for religion based on lessons learned from physics; and Margenau, despite his defense of the doctrine of Creation and his frequent allusions to Luther, Tillich, and Schleiermacher, did not appear primarily concerned with the specifics of Christian revelation. Indeed, he confided to church historian Jaroslav Pelikan (also a Lutheran) that he continued to wrestle with the "ambiguities of Lutheranism" (Pelikan 1993). Despite apparent sympathies, then, the Christian theologian and the religious physicist moved in distinct realms of discourse, pursuing distinct agendas.[11]

A Religion of Science

Tied to the problem of faith, and suggesting additional problems for reciprocity, was the sense that science itself was religious. On the one hand, Margenau wished to maintain a distinction, if not full separation, between the realms of religion and science. On the other hand, he often spoke of the commitment to inquiry as if it were a religious commitment.[12] Although he often noted that questions arose in the course of investigation which fell outside the purview of science, he also frequently added the caveat that he was talking of science as presently understood. Though he himself viewed agnosticism as unwarranted, his equivocation here seemed to support that intellectual stance—a preferred "boundary posture" for the modern scholar (Turner 1985). At the root of this ambiguity lay a bedrock

commitment to never-ending inquiry, a commitment to the ongoingness of research which, Weber had argued, alone justified the academic life. At this level of discourse, Margenau appeared to follow a long rhetorical tradition which upheld the religious quality of research as a means to defend science from its critics (Hollinger 1989).

In this vein Margenau himself articulated a "creed of modern science" (Margenau 1953, 19–20; [1961] 1983, 76).[13] The tenets of this creed began with the conviction that "the search for truth is a never-ending quest," and Margenau pledged himself "to seek it." The scientist, Margenau maintained, foreswore any belief in "ultimate" or "absolute" answers. He considered "all claims as provisional conclusions." The scientific creed held as sacred the "restless" task of investigation and the ongoing challenge of interpretation. In this never-ending process, every "mystery is but a challenge," and "no subjects and no facts" were closed to inquiry. Moreover, in this essentially humanistic view of science, "new principles of understanding [were] constantly being created through the efforts of man." Because of this dynamic quality, "any philosophy which sees the answer to all questions already implied in what is *now* called science is presumptuous and contrary to the spirit of science." Here Margenau had in mind the "dogmatism" of scientific materialism, which he, along with other theoretically minded investigators, had relegated to the dust heap of history (Margenau [1961] 1983, 239). In the context of Margenau's amalgamating strategy, the dynamic, nondogmatic temper of scientific inquiry created prospects for a renewed relationship with religion. At the same time, however, his creed evinced a sacredness to the quest itself.

The religious quality of research became explicit in a parable Margenau often told to describe the scientific life. In the story, adapted from Lessing, the seeker after truth comes before God, who offers that humble seeker a choice. The right hand of God holds eternal truth to be suddenly and completely possessed. The left holds the ongoing, never-ending *search* for truth. In Margenau's version, the seeker, faced with this decision, "makes a humble plea: 'Lord, open your left hand for me; let eternal truth remain a divine possession; grant me the virtue that I shall forever *strive* for truth, whose ultimate possession would produce a stagnancy I cannot endure.'" Margenau ends the story with the proclamation: "This was the scientist speaking" (Margenau 1955a, 110; [1961] 1983, 74; emphasis in original). Presumably, the physicist-philosopher saw the humble stance of the seeker as different from Weber's passionate pursuit of the next fact—a single-mindedness that Weber had insisted constituted the only justification for the life of research. Nevertheless, Margenau's account of "the true nature of science" appeared to provide a similar self-justifying account, collapsing any clear distinction between scientific and religious conviction.

The sense of the religiousness of science begins to expose the apologetic aspects of Margenau's strategy. In his talk on "the new faith of science," for

example (in which he first articulated his scientific creed), his principal concern had been "the place of science in the larger context of human affairs." Here he repudiated "the narrow concerns of the specialist" in favor of a broader role for the scientist (Margenau 1953, 3). Elsewhere, acting as a spokesman for science, he stressed that science was not about facts; science transcended the facts. The scientific enterprise ought properly to be associated with the philosophical pursuit of "understanding," not with the accumulation of mere "knowledge" (Margenau 1955a, 109). Indeed, Margenau often disputed the claim "that science is a collection of facts and formulas which serves pragmatic ends but never touches the soul of man." And he consistently disputed claims that advances in science threatened human or religious values. Instead he contended that "science is a highly aesthetic, exciting, creative enterprise covering far more of man's concerns than laymen often believe" (Margenau 1970, 95–96; [1961] 1983, 231–42). As he put it in his lay sermon: "In a very deep sense, science has its origin in the circumstance that in the deliverance of our senses, the facts are not sufficiently orderly to satisfy our desire for simplicity and consistency. Science is an elaborate answer to the paradox of the bruteness of our experience" (Margenau 1955a, 108). From the existential dimension of his thought, science shared in the task of articulating the meaning of human experience.

Margenau's argument for the dynamic, unending, and precarious pursuit of scientific understanding carried a defense of science against its humanistic critics. At the heart of his philosophy of physics lay a claim for the humanistic nature of science—a claim that made it difficult to distinguish epistemology from ideology, or reflections on the nature of science from a work of apologetics, or a promotion of religion from a justification of science. Not only was the scientist increasingly sympathetic to religion, and not only did the convergence of science and religion hold out the prospects of reciprocity, but at a fundamental level, the scientific task shared the truly human quest to make sense of existence. In defending science, Margenau left the impression, most likely unintended, that science might constitute its own religion. One could only take him at his word that this would not be enough to satisfy fully the longings of the human heart.

His Own Conclave

The ambivalences that emerged in Margenau's efforts at negotiation were expressed explicitly in a 1964 interview. In that interview, conducted by his colleague R. Bruce Lindsay for the American Institute of Physics oral history project, Margenau gave reasons for the reserve and caution with which he pursued his amalgamating task. He was asked by Lindsay about his interest in religion—an interest Lindsay clearly recognized, although he recalled that, at some time in the past, Margenau had been critical of

organized religion. Margenau responded that he did not remember that antagonism, but in any event he did admit that going public with his own religious concerns had presented real problems.

"Having lived in this country for some time," Margenau said, "I've come to the conclusion that a scientist who talks about religion is going to lose face among his friends in science." At the same time, there was the rather unsettling demand to *go* public. "You doubtless have had this feeling," he told Lindsay, "that once you accept a bid to talk about religion, every church around gets on your tail and wants you to talk some more." Caught between professional standards and public expectations, Margenau chose the path of philosophy. He decided, he said, that it would be "more proper to speak philosophically than to address oneself directly to the religious interest." To get to that place, he seemingly drew upon the German intellectual tradition that distinguished the task of church dogmatics from that of religious philosophy (Lindsay 1964, 78–81).

In the interview Margenau also revealed that he had "stayed away from religion in most of [his] writings" for pragmatic reasons. Suggesting the personal significance of his 1948 review of books, he explained: "I wanted to have my religion within my own conclave. I wanted to develop without exposure to multitude; and this has, in fact, taken place." By 1964, he was, he said, ready "to speak frankly about my religious convictions," and he mentioned a book that he had been asked to write on the subject (Lindsay 1964, 82). But it would take Margenau another twenty years to produce a work devoted to expressing his religious views. In *The Miracle of Existence* (1984a), he argued for the existence of a "Universal Mind"—a view of God, he said, consistent with current physics and compatible with a number of religious traditions. In this work, and in an open letter published in the following year (Margenau 1985a), he discussed the problem of evil, the issue of miracles, the efficacy of prayer, and the likelihood of an afterlife. He seemed to reinforce his point about the need for faith to move beyond the limits of scientific understanding. Yet here, too, ambiguities persisted, requiring further clarification. Eight years later, at the age of ninety-two, he published his last book, *Cosmos, Bios, Theos*,[14] taking pains to deny the pantheistic implications of his earlier work and stressing his belief in a Creator God (Margenau and Varghese, 1992). And in private correspondence, he confessed, "I myself am a Christian and partake in Christian worship and rites. We are all children of God, but Jesus was his most beloved son and is *our* redeemer. And I fully agree with you in solemnly accepting the need and urgency of human redemption through Christ" (Margenau 1985b). This disclosure, however, remained generally private. In public, Margenau tried to be a *generalist* in religion.

Overall Margenau pursued a complex public role of sage and seeker and religious consultant with great circumspection. His apparent caution, in fact, led a number of scholars in the science-religion discussion to question

his contribution (Barbour 1993; McMullin 1993; Smith 1992). If his colleagues in *science* seemed more appreciative of his efforts, it was to acknowledge his religious sensibilities and his "example," while generally remaining unclear about his particular religious beliefs or his impact on religion and science (Polkinghorne 1994; Townes 1994; Sandage 1990). Perhaps Edmund Sinnott is the best guide in this matter. As a noted plant morphologist at Yale and a contemporary of Margenau's, he also was enmeshed in the project of reconciling religion and science. From this perspective, he considered Margenau a "modern prophet" whose views had challenged the prevailing reductionism in science. Sinnott believed Margenau's thought would become increasingly influential in "religious philosophy" (Sinnott 1966; Hiebert 1986, 432–33).

In fact, however, an exchange of letters between the two scholars indicated the limits of their authority to counter the prevailing settlement between science and society. In that exchange, Margenau praised Sinnott for his forthright stand against reductionism. He particularly appreciated Sinnott's open-mindedness to psychical research. He gently chided his colleague for conceding too much to the opposition and for expecting "an indictment of [the] mysticism" present in his work. Margenau reassured Sinnott that everyone spoke admiringly of "the courage you show in dealing publicly with these important problems." He urged Sinnott not to bow to "cheap criticism" (Margenau 1965b). The tone of these letters, along with Lindbeck's observations, suggests once again the profound difficulties in renegotiating the boundaries of intellectual culture, boundaries marked by processes of specialization and a positivist outlook. In the end, it is difficult to shake Weber's specter of a disenchanted public world in which the gods had withdrawn and the scholar had lost his prophetic voice. Margenau's own unease with his mediating role reflected the limits of expert authority to re-enchant the world and to play the role of modern sage.

Conclusion

As his friend Edmund Sinnott had suggested, Henry Margenau's lifelong effort to integrate science and religion had the earmarks of a tragic heroic quest. Throughout his career, and on into his retirement, Margenau pursued a synthesis of science and religion through the philosophy of science. He worked to parlay the prestige of the physicist into a public platform for the philosopher. His reflections on scientific method led to a view of physical reality as a human construction—constructed out of experience according to definable rules of understanding. Margenau's constructionist epistemology envisioned a reorientation of the inquiring self toward the external world, an orientation productive of a metaphysical attitude and grounded in a new modesty among scientists. Margenau's view of the nature and limits of scientific thinking led him to urge a new sympathy with religion.

He proposed parallels and sketched out areas of contact between scientific and religious understanding; and he noted how the novelties of the new physics facilitated passage between the two realms. He advocated a reciprocity between the authorities of science and religion, and he genuinely anticipated a convergence of worldviews. He worked with a number of religious groups in a variety of public settings, offering assurances about belief and suggesting ways out of conflict. He sought some collaboration with theologians. Ultimately, Margenau offered a common method and a shared humility which he hoped would sustain a science of religious experience, making public a private resolution.

But Margenau's efforts tended to expose the limits of scientific authority to renegotiate the boundary lines in intellectual culture. His efforts to integrate knowledge and to overcome the tyrannies of specialization were appreciated by some, resisted by others, and a source of puzzlement to a few. His amalgamating strategy displayed certain ambiguities, along with an apologetic cast, both of which reflected the difficulties of balancing commitments to various constituencies and of playing different roles. Moreover, he pursued his "fondest hope" with circumspection, apparently unable to shake completely that mindset of the modern physicist that felt unsure in foreign realms of discourse. As a religious consultant, he acted as an outsider, seemingly never at home in any particular religious community (other than the university religious community which revolved around Battel Chapel, where he faithfully attended services, and around Dwight Hall, where his funeral was held). In the end, Margenau seemed to prefer his "own conclave," even as his ideas and authority were appropriated by various groups with distinct approaches to re-enchantment (Schilling 1962; Varghese 1992; Dossey 1989).

That conclave consisted of a select group of public intellectuals whom Margenau himself described as "theoretically minded investigators" and whose reflections from the cutting edge of scientific research seemed to point to the metaphysical horizon. The ideal social role of these men of knowledge was perhaps best articulated by the German physicist Herman Weyl, a physicist-philosopher whom Margenau cited as an exemplar of the new scientific attitude. Weyl, in his own series of public lectures at Yale, had described himself as "a mathematician [who] steps before you, speaks about metaphysics and does not hesitate to use the name of God" (Weyl 1932, 1; Margenau 1948, 316). As Margenau tried to occupy this same public space and exemplify the new modesty, he encountered some of the boundaries of intellectual culture enunciated by Weber. Margenau's own pursuit of a scientific vocation revealed the limits of translating the authority of the specialist into the role of the mediator, the insights of the philosopher into the vision of a prophet, and the humility of the seeker into the wisdom of the sage.

Notes

1. In the title of his address, *Wissenschaft als Beruf*, the term *Wissenschaft* has a much broader meaning than the English term *science*. As any number of scholars have suggested, *Wissenschaft* needs to be understood as *scholarship* more broadly conceived. At the same time, Weber's notion of *modern* scholarship, as necessarily entailing a single-minded dedication to narrow research, fairly describes the "scientific ideal" (see Veysey 1965, 125–33; Schwehn 1993, 6–12, 20 n. 2; Marsden 1994, 99–112; Cherry 1995, 31–34). For a book-length treatment of Weber's address and a sense of the controversy it stirred, see Lassman and Velody 1989.
2. A number of scholars have analyzed the same phenomenon in different terms. Henry May (1956; 1964), following George Santayana, has described the demise of Victorian confidence in terms of a "loss of innocence" and collapse of the "genteel tradition." Frank Turner (1978) has described similar trends in intellectual authority in terms of professionalization. For an analysis of the *Bildung* and *Idealismus* intellectual tradition see Ringer (1969; 1979, 411).
3. Frank Turner (1978) and Steve Shapin (1990) have described these same parameters in terms of the "professional ideology" of positivism and scientific naturalism.
4. In his analysis of the public debate that followed Weber's address, Ernst Troeltsch described this idealism in terms of a demand for a "new science." He quoted one of the major spokesmen in that debate as defining the new science in these terms: "[Von Kahler's book] speaks in the name of a 'youth which, convinced of the implacable necessity of a spiritual transformation, is seeking to put science on a new, clear, methodically secure and universal foundation'" (Troeltsch [1921] 1989, 58).
5. Paul Tillich, fifteen years Margenau's senior, expressed the mood in terms of a "generation of transition" caught between the demands of the modern industrial state and a classical ideal of the educated man. Tillich observed that "amongst intellectuals of the '20s, there was a kind of aversion against the scholar in the restricted sense of the 'expert'" (Tillich 1966, 18, 25, 41).
6. When asked how he "managed to gain the ear of physicists when talking philosophy [Margenau] replied: 'By continuing to do physics'" (Bunge 1978, ix).
7. Philosopher of science Bas van Fraassen (1995) noted that Margenau's very early (1936) interpretation of the Einstein-Podolski-Rosen (EPR) paradox put a finger "on the absolutely crucial point." That point was bolstered by Margenau's position as a practicing physicist. It proposed to dissolve the paradox by abandoning, in the words of another reviewer, "the unreasonable assumption that wave-packet reduction is a necessary feature of measurement" (Cohen and Park 1992, 655). A key contribution here involved Margenau's distinction between the preparation and measurement of quantum states. In addition, he applied his theory of intermolecular forces to a fundamental issue in the philosophy of science involving the Pauli exclusion principle (Cohen and Park 1992, 655); and from his quasi-idealist point of view, he addressed the problem of causality by arguing for the predictability of probability fields. More generally, Margenau was credited with the idea of "rules of correspondence," which, in his system, regulated the correlation of mental constructs to sense data (Nagel 1961, 120–29).
8. The director of the foundation, Fritz Kunz, was an educational reformer who had become enamored with the similarities between modern physics and the wisdom traditions of India and Greece. He persistently assailed the dangers of overspecialization, worked against the divisions between the humanities and sciences, and opposed the "evils" of positivist, objectivist, and reductionist thinking, along with the destructive influences of mechanistic materialism. In the words of Kirtley Mather, Harvard geologist and longtime president of the foundation, Kunz called for a "restoration of 'idealism' . . . through 're-union of science with the cultural heritage,' by means of the 'valid, authoritative metaphysics [which] has arisen from physics itself'" (Mather 1972; Durbin 1996, 232–38). More recently Kunz has been recognized as "the earliest pioneer of the current movement that tries to reconcile science and mysticism" (Weber 1986, ix).
9. Margenau's general approach echoed the views of Yale theologian D. C. MacIntosh, an important progenitor of empirical theology. MacIntosh argued that, under "the test of the scientific method . . . what is superstitious and thus clearly non essential will have to go, if that which is essential is to be revealed as true and impregnable." In his effort to address his own "deep concerns," Margenau seemed to follow MacIntosh's lead (see MacIntosh 1922, 158; Cherry 1995, 15–16, 98, 140; Livingston 1971, 418–28; Dean 1986).
10. Sloan (1994) suggests, and John E. Smith (1992) concurs, that whatever suspicions theologians of the forties and fifties might have harbored toward Margenau's approach were exacerbated in the context of the "theological renaissance" of the time (see also Bass 1991). For Virginia

Corvin's comments on Margenau's presentation, see her marginal notes on Margenau's paper (Margenau 1955b). She wondered about the definition of such concepts as "nonmaterial fields" and "singularities in space" and the "latency of observables," along with the possible "confusion of *non percipi* w[ith] *non esse*."

11. It should be noted, with due irony, that Catholics of the period appeared more interested in dialogue with Margenau (and philosophers of science generally). Mention has been made of Margenau's Aquinas Lecture given in 1958. A year later he returned to Marquette to help direct a conference on the nature of physical explanation. The appeal seemed to relate generally to the application of a neo-Kantian turn-to-the-subject to a reworking of Thomism. But even here, the prospects for dialogue seemed to fade in the sixties—perhaps as the importance of Bernard Lonergan's focus on method in theology began to fade.

12. Margenau was not unique in this particular ambivalence. In his various reflections on religion and science, Einstein talked about two realms while arguing for a religiousness of science—"a cosmic religious feeling" shared by scientists, artists, and certain "primitive" religious believers. More recently, the late Carl Sagan and, to some degree, Stephen Jay Gould exhibit the same tendencies.

13. For a contemporary penchant to enunciate professional "creeds," see the various books in the "Credo Series" of the 1960s. The editor of that series, Ruth Nanda Anshen, proclaimed its purpose as one of "unlock[ing] a consciousness that at first sight may seem to be remote but is proved on acquaintance to be surprisingly immediate, since it stems from the need to reconcile the life of action with the life of contemplation, of practice with principle, of thought with feeling, of knowing with being" (Anshen 1966, 9). Contributors included Edmund Sinnott (1966) and Werner Heisenberg.

14. The religion editor of *Time* called *Cosmos, Bios, Theos* "the most intriguing book about God" published that year (Ostling 1992).

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