

AXIOLOGICAL VALUES IN NATURAL SCIENTISTS AND THE NATURAL SCIENCES

Rem B. Edwards

REM B. EDWARDS is Lindsay Young Professor of Philosophy, Emeritus, at the University of Tennessee, Knoxville. He has published 22 books and more than 105 articles and reviews. His most recent books are: *John Wesley's Values—And Ours* (2012), *Spiritual Values and Evaluations* (2012), *An Axiological Process Ethics* (2014) and *What Today's Methodists Need to Know about John Wesley*, (2018). He has also edited and contributed to two other series of books. Two Hartman-related books that he edited, and one other book he wrote, are available for free download at <https://www.hartmaninstitute.org/additional-axiology-books>. Throughout graduate school at Yale and Emory, he was a Danforth Graduate Fellow. He received a BD degree (now MDiv) from Yale Divinity School in 1959 and a PhD in Philosophy from Emory University in 1962. You can read many of his published articles for free at: <https://utk.academia.edu/RemBEdwards> or at: <https://www.researchgate.net/profile/Rem-Edwards/research>

Abstract

This article explains that and how values and evaluations are unavoidably and conspicuously present within natural scientists and their sciences—and why they are definitely not “value-free”. It shows how such things can be rationally understood and assessed within the framework of formal axiology, the value theory developed by Robert S. Hartman and those who have been deeply influenced by his reflections. It explains Hartman’s highly plausible and applicable definitions of “good” and related value concepts. It identifies three basic kinds of value objects and human evaluations of these, and it shows how these should be ranked or prioritized in comparative worth. Finally, throughout, it applies all of the above to what is really going on within natural scientists and their sciences. It shows how anyone, scientists included, should proceed in order to make sense of what and how they value.

Introduction

If you had to identify and assess, i.e. evaluate, someone’s values, how would you proceed? This “someone” might be yourself, other individuals, or some group of individuals like natural scientists, but the basic problem is the same for all. Would you know where or how to begin to do this?

For present purposes, let’s assume that you want to assess the values of some group of individuals like active, creative, and published natural scientists, and explain to them how thoroughly value-laden their lives and their work really are. How would you proceed? This question has to be answered both practically and theoretically. *Practically*, you might interview them in person, or ask them to take a “values test” like the “Hartman Value Profile” that will reveal

their true values, or you might read their published articles and works and try to single out the values expressed in or presupposed by them. There may be other ways to get the information you need about what and how they value. Then what? This article shows why and how natural scientists and the natural sciences are value-full, not value-free, and how to understand and assess them.

The *theoretical* question is more difficult. What would you have to bring with you to the task of assessing anyone's values, scientists included, once these values have been identified in any of the above practical ways? If you bring no "tools" with you, no theoretical frame of reference, you will be at a loss to know what to do or how to proceed. Of course, you might bring your own unconscious, half-conscious, relatively superficial, little thought-out, and poorly organized values and evaluations to the task. Even these will not be of much use until you bring them into the light of consciousness, order them rationally, and decide that they are reliable and relevant.

Finding a reliable and plausible understanding of value theory to use in assessing anyone's values, including your own, is not easy. Yet, without such an understanding, the job cannot be done. Philosophical value theories are "a dime a dozen." I will not burden readers with a lengthy survey of all the alternatives. I am a retired professional philosopher. Value theory was for many years one of my areas of specialization. I spent most of my lifetime trying to understand and assess many diverse philosophical theories, especially theories of value. To make a long story short, I will simply outline what I believe to be a workable theory of value, an "axiology." All things considered, (and there is much to consider), this is the one theory that seems to me to be the most rational, defensible, plausible, applicable, promising, and practically useful. This theory was originally developed by the philosopher, Robert S. Hartman. Since his premature death, this axiology has been further developed and applied practically in many fruitful ways by his former students and colleagues, as well as by many professional consultants and members of the Robert S. Hartman Institute, www.hartmaninstitute.org. The theoretical parts of this discussion have been previously published and will be familiar to readers of my writings, but the applications here to science and scientists are new.

Any viable axiology or theory of value must provide plausible answers to several important questions. First, what is the meaning of "good" (and other key value concepts)? Second, if there is more than one kind of goodness or positive value, what basic kinds are there? Third, if there are several basic varieties of goodness, how can they be prioritized or ranked? Finally, how can answers to the first three questions be applied to such value-laden domains of human interest, thought, and activity as psychology, religion, businesses, sports, and the natural sciences such as biology, chemistry, physics, astronomy, etc.? In application, how can this axiological theory help us to understand ourselves, others, and the values present in all academic and practical disciplines, but centered here on natural scientists and the natural sciences?

I will next outline Hartmanian answers to these very basic questions about values. Obviously, the whole story cannot be told here. I will not footnote most of what follows, but everything can be documented within the two books listed in the WORKS CITED at the end. My own book, *The Essentials of Formal Axiology*, will be a bit easier to understand than Hartman's, *The Structure of Value*. As the discussion proceeds, illustrations and applications of these three basic elements of axiology will focus primarily on natural scientists and their sciences.

1. The Meaning of “Good” and Related Value Concepts

So what does “good” (and related value concepts, defined later) really mean? Hartmanian value theory offers a very workable and defensible answer: Something is “good” if it has all of the qualities or properties that it is supposed to have, that is, if it fulfills all of our ideal expectations for it. These expectations exist as concepts or ideals within our minds. As Hartman worded it, “‘Good’ is concept fulfillment.” This is the real meaning of the “Form of the Good” for which philosophers have been seeking since Plato. Hartman was the first to define it credibly. The ideal qualities or properties that any particular good thing must have are called its “good-making properties.” Our expectations are not always very clear or well thought out, but good things can be identified as such only by first formulating an adequate understanding of what we expect or are looking for, and then checking to see if the things to which we apply our ideals or norms actually have these expected “good-making properties.” So, if we want to identify a “good scientist” or a “good science” and understand the values inherent in them, this is how to proceed. Anything is good if it fulfills or exemplifies its norms, so, to find scientific goodness, we must identify or create the relevant norms or standards, then apply them.

Some desirable things, even in the natural sciences, don’t completely satisfy or meet our expectations, but they may do so by degrees. Things that fall somewhat short of our expectations could be called “fair,” “average,” “poor,” or “worthless” according to their degree of standard-fulfillment, or lack thereof. Some really undesirable or “bad” things may *lack* good-making properties (evils by *privation*), but others are evil because of the presence of “bad-making properties,” for example, assaults, malice, profound suffering, or mistakenly using the wrong chemical compound (evils by *presence*). “Bad” or “evil” can be defined as either “the absence of good-making properties,” or “the presence of bad-making properties.” Other value concepts can be defined axiologically in similar ways, as we will see.

Scientists may or may not be aware of the degree to which their work is value-laden throughout. They do realize that they regularly measure themselves and their work by applying given or established “professional” measurement criteria to themselves and their work. Scientists, their peers, their professional associations, and their journals, establish and enforce their own professional “good making” criteria or norms. They may not realize it, but these given normative standards identify and prescribe the most basic “good-making properties” that scientists are expected to “fulfill” or actualize. Scientists applying for grants to fund their work are well acquainted with “criteria-to-be-met” and what they must do to fulfill them. In addition, all scientists have their own professional and self-expectations, and their peers and colleagues expect certain things from them. Day to day scientific work constantly applies and is guided and judged by axiological norms.

If we want to know whether any particular scientists are “good” scientists, or if their research and experiments are worth doing, or if their theories are any good, we will make no progress toward answers until we first mentally identify the relevant ideal norms expected to be fulfilled. Only then can we, scientists included, begin to apply the ideal properties of “good” scientists, scientific research, future scientific projects, actual or anticipated experiments, relevant scientific attitudes and theories, etc. Only with a clear understanding and application of expected good-making properties can scientists themselves rationally discern their own professional worth, the

value of their scientific activities and products, and the goodness inherent within their particular sciences.

Only those scientists who completely fulfill the ideal expectations applied to them are really “good” scientists. If they fall short by degrees, they may still be “fair,” “average,” “poor,” or even “no good” as scientists. The same is true for scientific practices, applications, experiments, research projects, theories, systems, publications, teachings, etc. There are many degrees and kinds of standard or “concept-fulfillment” as Hartman called it, and many “degree” words are at our disposal for naming approximations to those norms.

Scientists do what they “ought” to do, or what it is “right” for them to do if and when they deliberately and effortfully try to do what would be best for them to do. (This is what such normative words mean. “Ought” and “right” just mean, “This is the best thing to do, so do it.”) In our everyday and professional lives, *most human judgments* of “good,” “better,” “best,” “ought,” and “right” are *not moral judgments*. They are *value judgments*, nevertheless. A particular scientist, or project, or whatever, A, is “better” than another, B, to the degree that A more completely fulfills the ideal expectations being applied to it, that is, only if A has more relevant good-making properties than B. This is what “better than” means—“having more good-making properties than.” All value concepts can be axiologically defined. Values and evaluations as such must not be confused with morality. *Most value judgments are not moral judgments*. The claim that “science is value free” may involve confusions about this.

We regularly use the word “good” to apply to all kinds of non-moral values, for example, a “good car,” a “good meal,” a “good salesman,” a “good teacher,” a “good colleague,” a “good experiment,” “good sex,” and a “good solution to our climate crisis.” Throughout daily life we regularly make judgments of “good or bad,” “better or worse,” “best or worst,” and we aren’t usually talking or thinking morality when we make such value judgments. Scientists regularly make value judgments like, “This is a good theory,” “This is a better experiment,” “This is the best way to do it,” and “This is the best conclusion.” None of these are moral judgments. Yet, they are value judgments. All such value judgments involve applying specific sets of “good-making properties” to something to determine if it meets our expectations. Well informed or rational value judgments are based upon a clear understanding of what these “good-making properties” are, and how they apply to the particulars being judged, that is, upon the degree to which the particulars exemplify specific sets of ideal properties and thus live up to our expectations. (Until we identify the relevant good-making properties, we really don’t know how to proceed with our evaluations.)

So, what exactly is a good scientist, a good research project, a good experiment, a good theory, etc.? What makes some university scientists good enough to be eligible for a promotion, or a raise, or a grant? Individual scientists, communities of scientists, their supervisors, their professional organizations and journals, and those funding them, regularly establish and apply their own professional criteria or norms (of goodness) in order to answer such questions. These norms are always context-relative (as are all applications of the “Form of the Good.”) Those who create and apply “criteria” for measuring the worth of scientists, scientific projects, etc., may not realize how deeply and constantly they are involved with values and evaluations. They may not understand just how thoroughly value-laden science and scientists actually are, but this is something they really need to comprehend.

2. Three Basic Kinds of Value and Evaluations

Is there more than one basic kind of goodness? Yes, there are many different kinds of goodness, and they can be found in scientists, research projects, experiments, theories, systems, publications, associations, etc. But how many different varieties of *really basic* “goodness” or “value” are there, and what are they? Hartmanian value theory offers very plausible and useful or workable answers. Here they are in outline, and as applied to natural scientists and their sciences.

Robert S. Hartman gave careful attention both to *what* we value and to *how* we value. He identified three really basic kinds of positive value that he called “dimensions” of goodness. Each of the three dimension categorizes specific kinds of *objects of value*, or *objects valued*. Each dimension also involves *evaluations*, i.e., *how* these three basic kinds of value-objects are to be assessed. Hartmanian axiology plausibly describes how we normally attach value to objects in each value dimension, and it prescribes the most appropriate way to do this most of the time. Some exceptions are allowed. Sometimes it is appropriate, or sometimes inappropriate, to evaluate every good thing as if it belonged to some other dimension of value. For example, scientists can love and intensely identify themselves with (intrinsically evaluate) their wives and children, but they can also love and intensely identify themselves with their theoretical sciences and their everyday practical work as scientists.

Properly understood, *evaluation* involves both *reason* and *feelings*. Many philosophers insist on only one or the other, but, as Hartman realized, we really need both. Each tells only half of the story. First, on a *rational* level, all objects of value should be measured by applying the “Form of the Good” to them: Something is good if it actualizes all of the ideal “good-making” properties that it is supposed or expected to have. Second, *feelings or affections* are always and inevitably present whenever *anyone* attaches value to anything, and there are appropriate normal ways to respond affectively to objects of value in each dimension of value. The whole domain of natural science involves both ideal standards and appropriate (or inappropriate) feelings, though this is often poorly recognized and understood.

Systemic value objects are mental or conceptual symbols that exist primarily in our own minds, though they can also be written down. They are words, thoughts, concepts, ideals, constructs, beliefs, propositions, systems, theories, logic, math, formalities, etc. Scientists and all the rest of us have and constantly use conceptual symbols, along with criteria for separating the “good” ones from the “not-so-good” or “bad” ones. (The not so good ones could be false, vague, confused, incomplete, unverified, incoherent, etc.) Scientists often say, “That’s a good idea,” or “That’s a bad idea.” Words or thoughts (systemic goods) may themselves be valued and used for many purposes, but their primary worth is as symbols or signs of things beyond themselves toward which they point. Words enable us to deal symbolically with things that are not immediately present to us in experience, and with those that are. The capacity to represent things to ourselves with symbols, and then to combine these symbols in innumerable incredible, exciting, and illuminating ways, is enormously advantageous practically, socially, theoretically, and scientifically. Systemic values do have great value.

Sometimes we use words to refer to themselves, or to or other words. We use words for self-reference, to define other words, and to explain more complicated concepts and theories—all of which are systemic value objects. We may call systemic value objects ideas, concepts, definitions,

thoughts, beliefs, norms, principles, truths, proposals, scores, theories, systems, sciences, knowledge, formalities, computer programs, logic, math, etc. Sometimes we consciously value (or disvalue) concepts as concepts. There are good ideas and bad ideas.

Usually we use words to refer to realities beyond words. Many words have referents. They denote as well as connote. They point us toward realities beyond themselves (some good, some bad, some indifferent).

Natural science is largely a mental or conceptual game involving thoughts, beliefs, theories, and normative methodologies like the highly esteemed “scientific method,” carefully selected mathematical and logical systems, theories, premises, logical inferences, conclusions, etc. Many scientific words are also about realities. They refer us to what is going on in the world of nature. They help us to understand the world in which we live. Such knowledge is very valuable!

Essential to science also are the enculturating norms, expectations, traditions, practices, technical languages, and particular scientific cultures taught by precept and example to those preparing to enter specific theoretical or applied fields of natural science. Anything “scientific” that could be or actually is thought or taught is a systemic value object—whether consciously recognized to be such, or not.

Systemic evaluation describes and prescribes two things. First, it applies the “Form of the Good” to scientific thoughts, beliefs, systems, theories, math, professional norms, etc. What are the relevant good-making properties? Which instances have the good-making properties expected of them? Which ones don’t? (Those of “creation science” probably don’t.) Scientists regularly ask, “Is this the best (most ideal) system, math, theory, methodology, assumption, practice, procedure, proposal, etc., to use in this natural science for this particular scientific purpose or project?”

Second, so-called “objective” systemic evaluation in the natural sciences (or anywhere else) is not devoid of *all* feelings or affections. Objectivity is an honest, impartial, unprejudiced, open-minded search for scientific truth or knowledge. Scientific objectivity always allows a place for many human interests, attitudes, desires, preferences, and affections. It excludes *only those* that would interfere with an honest, impartial, unprejudiced, open-minded search for scientific truth or knowledge. Methodological, rational, or scientific objectivity should never be confused or identified with metaphysical determinism or reductionism, though this often happens.

Impartial and fair-minded scientists can and do have passionate interests in and curiosity about their subject matter. They may have intense desires for scientific knowledge or truth and positive (or negative) attitudes about what they and other scientists are doing. They may also gain immense satisfaction and personal fulfillment from their own work, progress, discoveries, and creative insights; and they may also delight in the scientific efforts, creativity, progress, and findings of others. Even with such allowable feelings, scientists can still try to respond to all scientific ideas, beliefs, projects, and truth-claims with *impartiality* or *objectivity*, that is, with honest, fair, and open minds that are free from prejudices and *distorting or distracting* feelings—but not free from *all* feelings. Objectivity itself is highly valued or cherished! Scientists always operate with ideal norms and allowable evaluative feelings, even if they sincerely but mistakenly believe that their work is completely “value-free.” Intensely involved judges, jurors, scholars, and natural scientists are *expected* to evaluate their subject matter and do their work in fair-minded and intellectually honest ways, but they are not expected to be feelings-free. “Objectivity” is itself an intensely

valued scientific norm. Scientists *feel* strongly about it, even while assuming (mistakenly) that science is “value free.” Objectivity, as just described, with all its allowable norms and feelings, is a highly regarded or valued feature of natural science and scientists.

Science and university knowledge generally are often alleged to be “value free.” This may be called searching for, finding, and teaching “knowledge for its own sake.” However, today especially, the quest for scientific knowledge is usually financed by corporations for profits and by governments for war, national prosperity, the common good, political power, etc. Scientists themselves expect substantial financial and social rewards for their work. Clearly, such knowledge, science, or truth is not merely “for its own sake.” It is not completely “value free.” It serves the values of those who pay the bills. The natural sciences are often pursued and taught for the sake of wealth, ambition, curiosity, reputation, recognition, and professional advancement—all highly valued, all value-laden, all allowable. So it is with all college professors. They want to teach what they judge to be *worth* teaching and knowing—and ignore the rest.

College students today are not encouraged by their culture or by many, if any, of their professors to value and pursue knowledge for its own sake. They learn and are taught, even by university scientists, to pursue knowledge the sake of profit and prestige, that is, in order to make a better living, get a better job, make more money, have higher social standing, and live more extravagantly. They do not go to college seeking knowledge for its own sake; they go to learn how to make a better living. Most college graduates have indeed been taught how to make a good living, but they have learned very little if anything about how to live a good life, a meaningful and worthwhile life. They have little or no understanding of appreciation for the common good and how to sustain livable communities. Most of today’s colleges and universities have abandoned the now “antiquated” idea that a liberal arts education is “valuable for its own sake.”

Actually, wherever used, the expression, “knowledge for *its* own sake” should never be taken at face value. This expression is usually left undefined and unexplained. Its advocates can’t or don’t elucidate its meaning. It requires much more careful attention, examination, analysis, and clarification than it usually receives, no matter how much scientists affirm it, or how many universities officially proclaim it to be their sole or primary objective. Strictly or philosophically understood, the expression “valued for its own sake” means “*considered and valued for itself, all by itself, i.e., in isolation from everything else.*” At least, that is what philosophers mean by “for its own sake.” But that is not what is usually meant by “knowledge for its own sake.” This usually means that knowledge is directly and immediately enlightening, enjoyable, self-fulfilling, and/or useful to unique, conscious, sentient subjects and seekers like us. “Knowledge *only for its own sake*” usually means “*only for our sakes.*”

Dictionaries of common discourse define “for its own sake” as valuing, pursuing, or doing something “because someone enjoys it.” This could be expanded to include “because someone finds it directly interesting, enlightening, enjoyable, or immediately satisfying and self-fulfilling,” or “because someone is curious about it,” or “because someone finds the information useful.” Obviously, all of these are *for some person’s* enlightenment, enjoyment, satisfaction, and self-fulfillment, or as satisfying *some person’s* interests or curiosity, or as being useful *to someone*, but definitely not for *its* own sake, not even “pure” as opposed to “applied” science. “For *its* own sake” should not be confused with “for the sake of *some person’s* enlightenment, interests, curiosity,

self-satisfaction, self-fulfillment, enjoyment, or use.” No one, scientists included, should confuse things that are *good for us* with things that are *good in, to, and for themselves*. The “intrinsic worth buck” stops with unique, aware, sentient, conscious subjects—people, animals, and perhaps beyond. Still, knowledge is indeed good for us.

Does any of this apply to natural scientists? Scientists obviously enjoy the pursuit and acquisition of scientific knowledge or enlightenment; they regard this as a very good thing. They are highly motivated to pursue such knowledge *because* doing so satisfies and fulfills their own personal and/or professional curiosity, interests, and ambitions (in addition to possibly paying well). Carefully considered, scientists do not value scientific inquiry, discovery, and knowledge “for *its* own sake,” if this means “for itself all by itself, in isolation from all human interests, attitudes, desires, preferences, needs, satisfactions, enjoyments, ambitions, and wonderments.” Scientists actually value scientific knowledge for *their own sake* and *for the sake of others* who might benefit from it, but not *for its own sake*. We should never confuse “for my or our sake or well-being” with “for its own sake or worth.”

Scientific knowledge in the abstract has no intelligible sense of “worth in, to, or for itself”. Neither does any other kind of knowledge merely as such. There really is no meaningful or intelligible sense in which knowledge, or truth, or science in the abstract, i.e., in total separation from human knowers and evaluators, has any “sake” of its own. Knowledge in the abstract, in complete separation from all human subjects, does not value itself; it does not know or care that it is valuable; it does not enjoy anything; it is not curious about anything; it does not inquire or wonder about anything; it has no interests in or desires for anything, it has no needs or goals of its own, *it has no “sake” of its own*. It is only a human conceptual construct or abstraction. Human knowledge, or truth, or science is always for *our* sakes, never for *its own*.

This is true even if scientific knowledge does nothing more than satisfy the interests and curiosity of merely one researcher. Valuing, enjoying, wondering, creating, inquiring, being fulfilled by, having attitudes, desires, preferences, needs, interests, goals, etc. are properties only of unique, conscious, sentient subjects, not of abstractions like “knowledge,” or “truth,” or “science.” Such abstractions, considered merely in themselves, have no consciousness, no feelings, no interests, no needs, no desires, no preferences, no satisfactions, no self-realizations, no objectives, and no values—of their own. They have no capacities for enjoyment, curiosity, care, or love, etc. The knowledge we seek and value *always exists for and within people, never merely in, of, and for itself*. Knowledge is valuable *only because* people like scientists (and others) attach significance to it and affirm its worth. Knowledge is valuable only because it is good for us, not because it is good for itself. Apart from conscious individuals, knowledge does not even exist, much less have value. Many abstractions exist (and have value) only in our minds.

Knowledge is very *good for us* because in many ways it greatly enriches the lives of human beings (including scientists) and other intrinsically valuable living things. Its worth is always for our sakes, never for its own. In extreme cases, scientific knowledge may satisfy the interests and curiosity of only a very few particular researchers or small groups of scientists, but even then its worth is not “for *its* own sake.” Some scientists may care for nothing more than satisfying their own personal curiosity, but even that is not value free. In some small way, it enriches their lives. Scientific knowledge is not value free even if only one person values it as “a good thing.”

Dogmatists, authoritarians, “ivory tower” professors, and many natural scientists may find it difficult to identify and acknowledge the intrinsic values and evaluations within their lives and in their work. “Ivory tower” or “absent minded” intellectuals tend to over-value theories, ideas, and beliefs—systemic objects of value—while under-valuing intrinsically good people and/or extrinsically good material things, processes, and practices. Some natural scientists may be very dogmatic, authoritarian, unhistorical, insensitive, and inhuman in their overvaluation of scientific knowledge. Of course, they are not all like that!

By contrast, *extrinsic value objects* are, by definition, the useful, tangible, sensory things, objects, activities, and processes of everyday life, including our own bodies, possessions, tools, and physical behaviors. We value such things as *means to ends beyond themselves*, as extrinsic or useful goods—useful to us. Knowledge itself (systemic value objects) can be valued extrinsically (for its usefulness) Scientists themselves are also constantly involved with tangible, observable, physical materials, research objects, experimental equipment, and other extrinsically useful inanimate means to achieving various scientific goals or ends—even if they do not realize that all of these are objects of extrinsic value. By (axiological) definition, the real value of all inanimate sensory materials, activities, and processes consists in their being *means to ends beyond themselves*. Hartman also regarded social standing, social roles, and all observable manifestations of these (e.g. conspicuous consumption, pretentiousness, etc.), as extrinsic values because they are inherently mindless and are typically treasured for their usefulness or practical advantages. Familiar everyday examples of extrinsically valuable physical objects are cars, houses, computers, tools, equipment, and all the gadgets, pills, and services being sold to us through television and other advertising media.

Extrinsic value objects in natural science are such things as human experiments, test tubes, microscopes, measuring instruments, physical computers, “atom smashers,” quantum cloud chambers, the Hadron Collider, the Hubble and Webb Space Telescopes, and all other kinds of experimental laboratory materials, equipment, objects, procedures, and activities—and the money that finances them. All are extrinsic goods—means to ends beyond themselves. Much scientific work is mental and theoretical (systemic), but much of it also involves constructing and manipulating useful and interesting physical objects, processes, and endeavors—extrinsic value objects—some very large, some very small, in size. Extrinsically, science is clearly not “value-free.” Natural scientists cannot avoid using, preferring, and choosing between desirable and undesirable physical research equipment, projects, and objects to be examined. They try to find the best, the most effective, efficient, desirable, and preferable physical means to their particular ends, purposes, aims, or goals. Goals or ends are values, and so are the means to such ends.

Extrinsic evaluation involves two things. First, on a rational level, it assesses the usefulness of sensory or physical things, processes, and activities by applying the “Form of the Good” to them, that is, by using mental sets of good-making properties that could be used to identify them useful, or more useful than their alternatives. All physical aspects of the natural sciences can be measured for their goodness by applying relevant good-making criteria to them (except when we really don’t know what we are looking for). Scientists and scientific institutions, traditions, disciplines, and journals establish and publish their own good-making criteria for such things, as we have seen.

Sometimes, their wider society has something to say about their standards. Without such criteria, scientists just don't know what they are looking for or how or where to look.

Second, on an affective level, extrinsic scientific evaluation responds positively to useful means to ends with very ordinary practical attitudes, desires, preferences, affections, concerns, and interests—what I call “everyday interestedness.” Each natural science includes its own permissible and inescapable varieties of everyday interestedness. The normal attitudes, desires, preferences, feelings, purposes, and interests of natural scientists are inseparable from their day to day work and are carried over into that work. Natural scientists never leave all of their normal human perspectives, attitudes, interests, aims, desires, interests, preferences, affections, needs, and feelings at home when they go to work. Scientists have all of these, and all are evaluative. Scientists also are only human.

Turning now to *intrinsically good things*, which are, by definition, valuable *for their own sakes*, i.e., *in, to, and for themselves*. They are *ends in themselves*. They mean something to themselves. They are present in but typically downplayed by all the natural sciences, whether acknowledged or not. But what are they? Answers to “What things are intrinsically good?” are philosophically controversial. As defended effectively in the two books found in the WORKS CITED that follow, axiologically, intrinsic value objects are unique conscious, aware, sentient subjects like people, animals, (maybe even responsive plants?), and God. Even in the natural sciences, such realities are present. Natural scientists themselves are such realities. Ethically, such realities are not to be treated and used merely as means to something else beyond themselves without their knowledge and consent.

Natural scientists, psychologists and medical researchers excepted, seldom deliberately include intrinsic value objects (or subjects) within their subject matter, but they are unavoidably present within their personal lives, inter-professional relations, professional goals and associations, and normative scientific or professional guidelines. Ideally, scientists should recognize and fully appreciate their own unique intrinsic worth, that of others who live and work with them, and that of all the human and animal subjects on whom they experiment, or who might otherwise be affected by their work and discoveries. Scientists today are required morally (and legally) by their wider society to consider how their research, its procedures, its objectives, its uses, its products, and its practical effects will likely affect the well-being of intrinsically valuable human beings, animals, perhaps other living things beyond that, and the environment that supports them. (This objective may conflict with doing science for profit, prestige, ambition, corporations, governments, etc. Some scientists disregard both law and morality, as we well know.) Scientists are also morally required not to fabricate or lie about the successes and results of their scientific inquiries, insights, and research experiments, not even for profits or fame. Violations of that norm are severely penalized. They still happen.

Intrinsic evaluations describe and prescribe two things. First, everyone, (scientists included), ought to be evaluated *rationally* by applying the “Form of the good” to them as unique conscious or sentient subjects. (“Ought to evaluate,” by axiological definition, means, “It would be best to evaluate it that way, so do it.”) At the intrinsic level, the “Form of the Good” consists primarily of ideal self-concepts and self-expectations. What are our own self-expectations, and are we living up to them? Are we being true to our ideal or “highest” selves? It also consists in respectful norms

and expectations applied to other unique intrinsically valuable persons, or to other conscious, aware, sentient subjects.

Intrinsic evaluation involves appropriately responding *affectively* as well as *rationally* to all intrinsically good realities. Intrinsic evaluation involves ecstatic “Aha” creative insights as well as feelings of intense love, compassion, concentration on, absorption into, sensitivity, joyfulness, acceptance, respect, commitment to, identification with, or union and bonding with—objects of value. (Anything belonging to any dimension of value can be evaluated in this way—even knowledge.)

Scientists try their best to bracket away any and all feelings that might interfere with intellectual honesty and objectivity. Still, scientists should be as sensitive and responsive as possible to the positive and negative feelings that are going on inside of themselves and others, without allowing these to interfere with their intellectual integrity, honesty, objectivity, and competence. Occasionally, they personally identify intensely with others, e.g. their co-workers, or their experimental subjects, and recognize them to be the unique subjects that they are. Morally, intrinsic affections include conscience, our internal moral sense, our carefully considered feelings of and beliefs about right and wrong, and good and evil. Conscience involves both feelings and thoughts. It works by approving of some thinkable kinds of behaviors, feelings, opinions, etc., and disapproving of others. Scientists need an activated conscience.

The degree to which intrinsic evaluations (conscience, compassion, love, respect, reverence, concentration, creativity, identification-with, etc.) have a legitimate place within natural science and scientists has not yet been adequately explored and understood. To what degree are scientists better scientists with or without such feelings? When would intrinsic evaluations interfere with scientific objectivity, and when not? Some modes of intrinsic evaluation really do have a prominent place in the lives and practices of natural scientists. Indeed, they are integral aspects of their own personal identities. Scientists tend to concentrate intensely upon, personally identify themselves with, and passionately love their respective sciences, research, theories, progress, and findings. They are exhilarated by “Aha” experiences of creative scientific insight and discovery. They constantly intrinsically evaluate and intensely identify themselves with the subject matter of their particular sciences, as well as with their own creative scientific intuitions, research projects, experimental activities, discoveries, and teachings. They relate axiologically to such things *as if* they were persons having intrinsic worth for their own sakes. They evaluate systemic and extrinsic values as if they were intrinsic values. This is axiologically acceptable as long as it is balanced by also intrinsically evaluating persons as ends in, to, and for themselves.

Scientists may or may not have axiological problems with the scope or extent of their intrinsic evaluations. To what degree do they fail to concentrate upon, personally identify with, and love other good things beyond their sciences? Systemic and extrinsic value objects can be evaluated intrinsically with intense devotion and fascination, and there is nothing axiologically wrong with that as long as intrinsic evaluations do not end at that point. Scientists who love *only* their sciences live very impoverished personal lives, socially and otherwise—but they still love something. Often, with difficulty, scientists try to find the right balance between their intrinsic personal and moral concerns and their scientific passions, between their extrinsic practical feelings and practices

and their systemic objectivity, intellectual honesty, and carefully considered teachings. Properly balancing that combination is definitely not “value free.” But how can and should this be done?

3. A Rational Hierarchy of Values

How can and should we, scientists included, prioritize our involvement with and commitment to systemic, extrinsic, and intrinsic objects of value? Are some of these three basic kinds of goodness inherently more valuable than others, and if so, why, and in what order?

Good things come in at least three basic varieties, systemic, extrinsic, and intrinsic. All are very good, but some good things are better than others. If so, why? Axiology can help get our priorities straight, but how? How can we tell which good things are better than other good things, and why they are? Such questions call for a rationally ordered hierarchy of values. Robert S. Hartman developed such a hierarchy, one that is very plausible and appealing, as explained next.

As we now know, all good things have what philosophers call “good-making properties” (qualities, relations, existence, etc.). Some desirable things are better than others because they have more or different good-making properties than these others. Axiologically, “better than” just means “having more (or significantly different) good-making properties than.” Sometimes, the “more”, the really important differences, are qualitative, not merely quantitative.

The three basic kinds of goodness previously identified can be properly ranked by degrees of worth. How so? Hartman’s hierarchy of value shows that intrinsic goods are better than extrinsic goods, and both of them are better than the obviously valuable systemic conceptual symbols that refer to them, but this needs some explaining. This means that *people (or other conscious sentient beings) are more valuable than mindless but useful inanimate things, and both of these have more worth than our mere ideas of them or thoughts about them.* Why? Because intrinsic goods have more good-making properties than extrinsic goods, which in turn have more good-making properties than the systemic goods that symbolize or refer to them. This “more” can be quantitative, qualitative, or both. Sometimes qualitative differences trump quantitative differences. A fuller account of this is given in the books in the WORKS CITED that follow. Yet, the essentials can be easily understood—and applied to natural science and scientists.

Consider the differences in value between *intrinsic, extrinsic, and systemic goods*. Our systemically valuable thoughts, ideas, concepts, systems, and beliefs usually function as mental *symbols* that point or refer to realities beyond themselves. That is their primary purpose, even in the natural sciences. Scientists are dealing with realities, not merely with words. That is largely what we expect of the natural sciences and why they are valuable to us. No one should confuse the value of intrinsically or extrinsically good realities with the worth of our mental tokens or symbols for them. All valuable realities (in natural science and elsewhere) have greater worth than our mere thoughts about them, i.e., our words or conceptual symbols for them, our mental beliefs about them, and our knowledge of them. That said, thoughts about good things do have great value, but not as much as the desirable realities to which they refer. Something can be very good without being the very best.

Languages contain words or symbols for good people, useful things, and interesting and fruitful ideas, but real people, useful objects and products, and well developed systematic theories, etc., are much more valuable than, have more desirable good-making properties than, our simple

conceptual symbols or words for them. To see this with respect to intrinsic values, ask yourself what you would prefer after careful consideration, the mere idea of a good friend or an actual good friend, a real spouse and family or mere thoughts, knowledge, or photographic symbols of them? Real people have good-making properties that mental symbols for them and useful inanimate things do not have. Real conscious sentient subjects have thoughts and profound feelings of their own, make their own choices, and engage deliberately and purposefully in innumerable practical activities. Unique individual persons are animate, conscious, curious, thoughtful, informed, valuing, affective, caring, loving, and compassionate—by degrees. These qualitative differences are difficult to quantify. Bank accounts, bottom lines, cars, houses, smart phones, lab experiments, scientific knowledge and systems, computer programs, math, logic, etc., lack all of these good-making properties. Real people, friends, loved ones, and scientific collaborators are worth more than our paltry thoughts about them. Compared to non-conscious extrinsic and systemic goods, people are “priceless,” as some philosophers have said. More and more, we are beginning to realize that this is also true of animals, starting most obviously with our cherished pets, but extending far beyond that.

Turning to extrinsic and systemic values, ask yourself which you would prefer, the mere idea of a new car or an actual new car, words about a new computer or a real one, actual money in the bank or only thoughts and dreams of such, a really successful experiment or the not-yet-actualized mental prospects of one, a well-developed scientific theory (e.g., relativity or quantum theory) or the simple notion or name for its possibility?

Desirable or extrinsically valuable physical entities and human activities are also more valuable than our words for, thoughts about, knowledge of, or mental symbols for them. We can actually spend the coins in our pockets, but not our thoughts about them. Real money in the bank is worth more than money that exists merely in our minds, thoughts, or daydreams, even if and when they are identical in numerical face value. Good persons and friends are more valuable than our thoughts, knowledge, or beliefs about them. Real moral motives and actions are more valuable than mental daydreams about doing the right or useful thing. Some philosophers say, perhaps mistakenly, that existence is not a “predicate” or “property,” that something must exist before it can have any properties at all. Yet, both fictional characters and real persons can have properties or qualities. Both imaginary money and real money can have properties and be counted, as can all fictions. Good things that actually exist are always better than mentally imaginary ones. Real existence does make a very significant axiological difference, no matter how we choose to classify it for other purposes. Existence is a good-making property for desirable things and a bad-making property for undesirable things.

Like most other people, natural scientists often fail to rank or prioritize intrinsic, extrinsic, and systemic objects of value in accord with their true worth. Overvaluing and undervaluing are common axiological errors for everyone. Valuing people as mere things, as inanimate objects to be used and abused, or as nothing more than systemic tokens, (e.g., as nothing but numbers tattooed on their arms), in ideological schemes, is a very bad thing. Slave owners did that, the Nazis did that, and so do employers and scientists who ignore the intrinsic worth of themselves, their employees, their co-workers, their experimental subjects, and any others who might benefit from

or be hurt by their endeavors. Do scientists ever evaluate other persons only extrinsically, i.e., only for their usefulness, simply as means to ends that these other persons do not personally share?

Nothing is morally wrong with treating persons (employers, employees, co-workers, customers, investors, patrons, fellow scientists, experimental subjects, etc.) as productive means to business or scientific ends—as long as they are also regarded and treated at the same time as ends in themselves, that is, without ignoring their intrinsic worth. As Kant suggested, morally, we should never treat people *merely* as means to ends beyond themselves that they do not freely and knowingly embrace on their own, but that does not mean that we can never use them as means at all. Morally we can treat people as means and “use them” just as long as we concurrently acknowledge and respect their intrinsic worth and interests. Scientific practices that exploit persons as *mere things*, mere means to ends beyond themselves, like performing scientific experiments on those who have not given their informed voluntary consent, are morally wrong. Not recognizing, respecting, and treating experimental subjects as real persons is always wrong. Yet, treating people as means to ends, though not merely as means, is morally acceptable as long as they are simultaneously valued, respected, and treated as intrinsically valuable ends in themselves having immense worth of their own for their own sakes. Morally and legally, natural scientists cannot ignore the worth, well-being, rights, personal fulfillment, and overall satisfaction of those who are affected by their work.

Obviously, the preceding applications of value theory to natural scientists and sciences tell only a fraction of the whole story, and much work remains to be done. Fortunately, axiology can be applied over and over again to the practically endless details of anything, including the natural sciences and their practitioners.

Shouldn't all natural scientists know at least this much value theory? I have written elsewhere that trying to explain values to people is like trying to explain water to fish. Values are so pervasive in all of our lives, in all of our mental, affective, and physical experiences and activities, that we just take them for granted and do not even notice that they are there, pervading everything. Explaining values to a natural scientist can't be any harder than trying to explain water to a fish!

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