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The Past and Future of the Psychology of Science

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As the British statesman Edmund Burke once wrote, "Those who do not know history are destined to repeat it." (Not to be confused with George Santana's comment: "Those who do not learn from history are doomed to repeat it."). The fact is that the history of the psychology of science has been a struggle for existence. If we wish to move away from struggle and toward a comfortable existence, then we need to learn lessons from the other disciplines that successfully have made the transition from fledgling field to fully established scientific discipline. The history, philosophy, and sociology of science are just such established disciplines.

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Learning From the Past

As the least developed study of science, psychology has much to learn from the more established studies of science (metasciences), namely the history, philosophy, and sociology of science. The most important lesson comes from knowing the general stages that any scientific discipline goes through in its path toward maturity. Guiding my discussion of the development of each study of science, I borrow from and modify Nicholas Mullins' (1973) stage model of theory or network development as well as Joseph Matarazzo's (1987) criteria for a new psychological field. Mullins argued for 4 potentially overlapping stages of development in theories and/or scientific networks in sociology. I propose only 3 stages and apply them not only to 1 field (sociology), but to all of the metasciences (history, philosophy, sociology, and psychology). In addition, I simplify the components of each stage and focus only on each stage's intellectual leaders, social-organizational leaders, research-training centers, and intellectual successes.

In stage 1, "isolation," scholars work on the same problem in isolation, with the founding intellectual figures setting the stage. There is no social organization in terms of training centers, conferences, or societies. Late in stage 1 and early in stage 2, a core group of scholars may be working in the field, but doing so implicitly rather than explicitly, not yet labeling themselves as members of the field.

In stage 2, "identification" is reached, as the intellectual success of the founding figures provides explicit theoretical and conceptual parameters for the field that attracts a wider range of students and other scientists who start to explicitly identify themselves with the field. Semiregular meetings are organized and the first training-research centers may form. Such training centers are usually highly centralized around an intellectual leader, whose students have begun to have a major impact on the field. A leading journal becomes necessary as the outlet for the increased level of productivity of the field.

In stage 3, "institutionalization," the field becomes well established and institutionalized. Meetings become annual conferences because societies have now formed with their own social structure and hierarchy. Often multiple societies, some of them international, become necessary. Training centers proliferate and become less centralized, and at least 1 journal is now required for the expanding productivity of the field. Indeed, splinter movements, with different foci or agendas, may form and either break away or stay on the edge of the central field.

Taking less of a stage perspective than Mullins, Matarazzo (1987) argued that a new field of psychology requires its own association or

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society, journals, postdoctoral training programs, and recognition from other scholars that it is its own distinct field.

As I reviewed in more depth in my recent book, *The Psychology of Science and Origins of the Scientific Mind*, the philosophy of science began the isolation stage in the 1840s, moved to the identification stage in the 1900s, and to the institutionalization stage in the 1930s. The history of science went through these stages in the 1750s, 1900s, and 1910s, respectively. Most recently, the sociology of science began to enter each of these stages in the 1920s, 1960s, and 1960s, respectively. In short, the 3 other major metasciences are fully ensconced in all 3 stages and each has been fully established for at least 40 years. The psychology of science, on the other hand, is somewhere between the isolation and identification stages and has not met any of Matarazzo's criteria (i.e., its own society, journal, postdoctoral training programs, etc.). Indeed, this special issue, my recent book, and other recent publications (e.g., Klahr, 2000; Simonton, 2004) are attempts to change the situation and move the field more completely into at least the identification stage, and ultimately to the institutionalization stage of development.

Although its origins reach as far back as the 1870s with Francis Galton, the psychology of science, by contrast, first earned its own name in the 1930s and had no more than a few scholars until the 1950s. During the decade of the 1950s, there was an upswing in research and theory on the psychology of creativity, including scientific creativity. Especially post-Sputnik, anything that helped foster an interest in science was encouraged and relatively well funded. During the 1960s and most of the 1970s, however, there was very little systematic work done by psychologists on scientific thought, reasoning, or behavior. But by the mid- to late 1980s, the field really stood at the precipice of being a full-fledged field.

Or so it appeared. The 1986 conference held in Memphis and organized by William Shadish, Barry Gholson, Robert Neimeyer, and Arthur Houts was a good beginning. Indeed, the books that followed from that conference (Gholson, Neimeyer, Shadish, & Houts, 1989; Simonton, 1988) were important sources of inspiration for me as I worked on my dissertation and gave me the confidence that the field could become an established discipline. However, no society, regular conferences, or journal sprouted up afterward. In the 1990s Ron Westrum at Eastern Michigan University started a newsletter ("Social Psychology of Science Newsletter"), but even that lasted but a few years.

Psychology of Science in the Future

In 1994, William Shadish, Steve Fuller, and Michael Gorman boldly claimed in the opening sentence of their 1994 chapter in *The Social Psychology of Science*, "The psychology of science has finally arrived" (p. 3). Has it? I believe that psychology of science is between the isolation and identification stages and therefore that it has not yet fully "arrived." More specifically, my argument is this: The psychology of science has not become an established and fully autonomous discipline, but during the 1990s and now in the 2000s, the field is showing signs of taking off, although primarily in hidden or implicit form.

Every major subdiscipline of psychology has active and talented researchers working on many different questions fundamental to understanding scientific thought and scientific behavior as well as scientific interest, theory formation, and scientific talent and creativity. Such names as Susan Carey, Alison Gopnik, Paul Klaczynski, Barbara Kosloswki, Deanna Kuhn, Elizabeth Spelke, and Corinne Zimmerman, are excellent examples—just from developmental psychology—of talented thinkers doing (implicit) psychology of science. In cognitive psychology, a list more explicitly identified with the field would include such figures as William Brewer, Kevin Dunbar, Michael Gorman, David Klahr, Roger Shepard, and Ryan Tweney. Giftedness and educational psychologists consists of such standouts as Camilla Benbow, David Lubinski, Julian Stanley, and Rena Subotnik. Lastly, there are such scholars as Dean Simonton and Frank Sulloway who cut across many traditional boundaries within psychology. The point is that some of the more talented and creative minds in psychology are interested in, have developed theories of, and have conducted research in what others and I are calling the psychology of science. The unique and interesting sociological question, therefore, is why do not more of them realize that is what they are doing.

I believe part of the answer lies in the fact that—with some exceptions—they are not familiar with or aware of the term "psychology of science." Indeed, there are no codified and institutional structures with which these scholars can identify. They did not get their PhD's in the psychology of science; there is no society to join; there is no journal to publish in; and there is no regular conference to attend. It is no wonder that many psychologists, even those studying scientific interest, thinking, talent, and creativity, do not identify with the field or call themselves psychologists of science. It is somewhat of a catch-22: If there were journals, societies, and programs in the psychology of science, many of the implicit psychologists of science would be explicitly identified with the field. Yet, as it stands, they do not identify with the field because there is no "there there." There are 2 major tasks awaiting psychologists of science before there is to be "a there there": (a) creation of an infrastructure and (b) development and testing of integrative theoretical models.

Infrastructure. It is my firm belief that much of the psychology of science is dormant, latent, and implicit, and it is one of my goals to make it manifest and explicit by laying the foundation for its infrastructure. Special editions of established journals are a beginning, but in the end the field must develop its own journal if it is to blossom into its own. There are thousands of journals in science today. In psychology alone there are literally hundreds of journals, many of which are ultraspecialized and focused on very narrow aspects of human behavior. For instance, just to name a few examples, there are journals in dreaming, epilepsy, psycho-oncology, hypnosis, parapsychology, transcultural psychiatry, applied sport psychology, school health, aviation, space, environmental medicine, circadian rhythms, and eating disorders. There is even a journal devoted to science education. In many cases there are multiple (at least 4 or 5) journals in the more specialized areas, such as dreaming, circadian rhythms, parapsychology, or hypnosis. My point is not that these are overly specialized areas and do not need the journals they currently have. Rather, my point is that if we can have multiple journals in such specialized areas, then we can and should have at least 1 journal devoted to the psychology of science. Science is such a ubiquitous and all-powerful force in modern culture that we need to examine empirically and theoretically all of the psychological factors behind the development of scientific interest, talent, and achievement. Moreover, we need a scientific outlet for publishing the results of these studies in one place.

Each of these developments is intertwined: Conferences of like-minded scholars would be the most likely and most feasible 1st step. Out of these conferences, research ideas and collaborations could form and foment further research. If scholars begin to produce enough original research, then a journal and society could follow. If these developments were to happen, perhaps then could we start talking about an actual rather than dormant psychology of science.

Integrative theoretical model for future testing. If psychology of science is to survive well into the future, then it needs to develop healthy theoretical-conceptual models to test empirically. As Dean Simonton argues in his contribution to the current issue, well-developed and paradigmatic sciences have strong and consensual theories from which testable hypotheses are generated. In the spirit of this position, I offer the following theoretical model for the psychology of science (see Figure 1). The model is a general conceptual diagram summarizing the major evolutionary-historical (external) and psychological (internal) factors that lie at the foundation of scientific interest, talent, and achievement (cf. Eysenck, 1995; Feist, 1993; Feist & Gorman, 1998; Helmreich, Spence, Beane, Lucker, & Matthews, 1980). Moreover, the model is based in evolutionary theory and suggests direction of causal influence, which in general goes from the biological to the social-environmental. Evolutionary theory has proved a useful theoretical foundation insofar as the human brain is both a product of evolutionary forces and is responsible for all human thought, including science. Evolutionary forces have shaped the human brain to be biased toward certain categories of information processing and knowledge, for example, people, objects, plants, animals, number, and language. These categories of knowledge in turn have become domains of science (social, physical, biological-natural history, and math). Simply put, the domains of science that exist today are

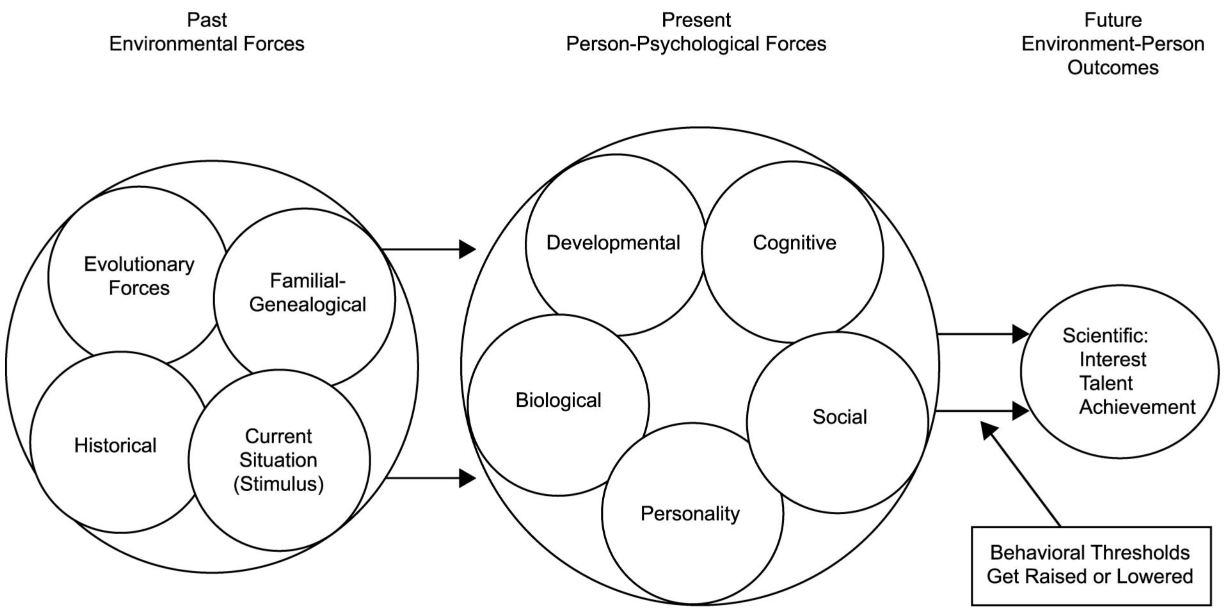

Figure 1. Integrative Model of Environmental and Psychological Influences on Scientific Behavior, Interest, and Talent. In Feist (2006) Psychology of Science and Origins of the Scientific Mind. Copyright, Yale University Press. Reprinted with permission.

not arbitrary but rather fall along evolved domains of knowledge.

The major environmental forces presented in Figure 1 consist of distant (evolutionary and historical) as well as proximal (familial-genealogical and current situation) influences. To develop a full and complete understanding of individuals, groups, and the species, one needs to have an appreciation of the evolutionary influences that have produced the unique traits and abilities of our species; the historical and cultural events of our more recent cultural evolution; the specific family genealogy of the individual; and finally, the current situation the person finds him or herself in at any given moment. For instance, the 3 major stages of human cognitive evolution I discuss in *Psychology of Science* attempt to explain how we went from ancestral hominid thinking to modern human thinking capable of symbolic abstraction and science.

External environmental forces causally act on the individual and all of his or her biological-genetic, developmental, cognitive, personality, and social processes. For instance, evolutionary and genealogical factors directly contribute to one's genotype, which make up, among other things, each person's central nervous system in all its neurochemical and neuroanatomical uniqueness. The variability in biological structures contributes to temperamental differences in infancy and early childhood, which in turn become the foundation for individual differences in intelligence and adult personality.

Some creative people develop talents in particular domains, whether they are in the social-psychological, physical-spatial, numeric-quantitative, or biological-natural history domains. Being thing- or people-oriented starts different people down different paths of science, namely, physical or social. Children are inherently incipient scientists and construct implicit domain-specific and domain-general theories of their social, physical, biological, and quantitative worlds (Gopnik, Meltzoff, & Kuhl, 1999; Kuhn, Amsel, & O'Loughlin, 1988; Karmiloff-Smith, 1992). As I reviewed in my contribution for this special issue, self-image, personality, and demographic forces (e.g., gender, birth order, religious background, and immigrant status) influence scientific interest as well. The earlier a child shows an interest in and talent for science, the more likely that person is to have a creative and productive career. Scientific creativity and productive achievement change over the life course, with peaks generally occurring 20 years or so into one's career. One's ability to use metaphor and analogy, to separate and coordinate theory and evidence, to systematically test hypotheses, to think complexly, to solve problems intuitively and by working forward each facilitate scientific reasoning and creative problem solving. Moreover, people with a certain cluster of traits, such as intelligence, openness, introversion, confidence, and independence, have lower thresholds for developing interest in and talent for science. Lastly, social and group forces (parents, teachers, mentors) lower thresholds for scientific interest and talent as well and depending on their structure, make interest and talent either more or less likely.

The circles in the model are somewhat intentionally broad and vague. Space does not permit the particular parameters to be specified, such as precisely which biological or developmental or personality forces lower thresholds for scientific behavior, interest, or talent. I have provided some of these details in the *Psychology of Science and Origins of the Scientific Mind*, but also I leave the task of doing so for future psychologists of science. The fact is that specific psychological qualities in every domain of psychology lower or raise thresholds and make scientific interest, thought, or talent more or less likely. We hope this special issue will stimulate potential psychologists of science to tell us more about what they might be.

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