THE SCIENTIFIC METHOD

An Evolution of Thinking from Darwin to Dewey

HENRY M. COWLES

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LABORATORY SCHOOL

Rats were not psychology's only new models. In the same laboratories where mazes were run and boxes were escaped, psychologists used a new organism to reveal the developmental roots of their own reasoning. These subjects were closer to home: human children. Kids could be brought into the laboratory, but it was more common to try to find them in their natural habitats. At the end of the nineteenth century, changes in the education system made primary schools the ideal sites for this work. Increasingly compulsory (and crowded), classrooms seemed to provide ideal settings for observing the behavior of children as they acquired and manifested new capacities. Studies of children dovetailed with those on animals: what nonhuman minds revealed about the historical development of science, human children demonstrated on a day-by-day basis. As psychologists set tests for kids at a range of ages, mental evolution almost seemed to happen before their eyes. Combined, as they often were, these studies of rats and children rounded out an emerging account of the scientific process as both a natural phenomenon and an artificial tool, as something at once fundamentally human and more than human.[1]

What was soon called "child study" rested on a set of assumptions that practitioners shared with the founders of comparative psychology, not least because the groups overlapped significantly. Studies of children and animals alike were framed in terms of recapitulation: the changes witnessed in early childhood were thought to mirror mental evolution over generations. An infant's ability to recognize shapes or a toddler's ability to navigate a room were versions of similar capacities in great apes, rodents, and the rest of the psychological menagerie. The parallel between humans and animals also broadened the meaning of "comparative" psychology. Leaving laboratories and entering schools (or turning schools *into* laboratories) did not mean abandoning the techniques developed to study nonhumans—it simply meant translating them into forms that would work on human children. Psychologists saw children in much the same way as they saw nonhuman animals: as proxies for adults, including themselves, and as windows onto their own ways of thinking. Blurring the lines between human and nonhuman subjects helped cement the basic behaviors being studied—including problem solving and learning—as fundamental, deeply natural processes. Even science came in for this kind of naturalization.[2]

Sometimes, kids came first. Thorndike's dissertation work and the controversy it caused had played out in response to recently published work by another young psychologist. Ernest Lindley, a student of Stanley Hall's, used puzzles to study children the same way Thorndike and Small studied cats and rats. While administrators had squashed Thorndike's studies of children, Lindley was allowed to test students in the Worcester public schools for his dissertation research. Armed with simple puzzles designed for children, Lindley timed how long it took students to finish them in successive stages. Much as his colleagues were doing with animals, he worked toward a simple goal: time curves that could be used to demonstrate the learning process as well as to compare across individuals. Hundreds of third-, fifth-, eighth-, and ninth-graders completed the tests, and Lindley published their results (and his analysis of them) in Hall's *American Journal of Psychology* in 1897. The article, "A Study of Puzzles with Special Reference to the Psychology of Mental Adaptation," had an immediate impact on comparative psychology. Cita-

tions appeared in the work of Small, Thorndike, and others who were turning psychology into the experimental study of mental behaviors as the nineteenth century came to a close.[3]

In Lindley's eyes, children were not just animals—they were scientists, too. From their innate sense of play shared with nonhuman animals, children gradually developed new means of adapting to the world around them through playful maneuvers and subsequent adjustments based on the *effects* of their maneuvers. Watching children work, Lindley thought that "the rising curve of puzzle interest marks the prepubertal age as the time to hasten transition to the higher mental methods." It was clear to Lindley and his readers that the distinction between higher and lower methods mapped onto the gap between conceptual reason and what he called "sense-trial and error." But in reality, the gap between child and scientist was not that wide. Both seek "joy in the overcoming of difficulties," from simple gestures to abstract theories. "Many movements of the young," Lindley wrote, "thus represent a kind of experimentation." And the converse was also true: a scientist's procedure, when confronted with a difficult problem, "may descend almost or quite to the lowest 'levels.'" Unfamiliarity and complexity were not the only causes of "descent," Lindley argued, "but also fatigue, temporary loss of interest, a fleeting state of mental muddle may produce a relapse into the animal method." Affective states that would have been familiar to readers were, for Lindley, the links between children, scientists, and nature's method.[4]

The idea of studying scientists was not lost on Lindley. "Of great value for the psychology of scientific method," he wrote, "would be the detailed account of the procedure of the most successful experimenters." Though such sources were rare, those we had suggested that science depended a lot more on error, accidents, and "fumbling" than was commonly believed. In other words, scientists were human: they screwed up, sometimes intentionally, and learned from their mistakes. Combined with the evolutionary arc of methods over time, this suggested a new goal for psychology: "a genetic view of the natural forms of adaptation, of the natural logic which organisms employ in dealing with novel situations." Lindley was optimistic: "Of manifest importance to biology and psychology would be the natural history of such processes, from the

lowest forms of conscious life to man, as well as from primitive man and the child to the adult scientest [*sic*]. Some studies of animal method, notably those of Romanes, Lubbock, Lloyd Morgan, Binet and Hodge have shown the richness of the field. Similar studies of children have as yet scarcely passed the anecdotal stage." From "animal method" to "child study," a generation of psychologists was forging a unified approach to methodology—including their own.[5]

Their work found a ready educational audience in the years around 1900. Expanding enrollments at all levels put a premium on effective teacher training and finding efficiencies in the classroom. Many psychologists in this period delivered lectures on the field's applications to teaching, paving the way for several inroads into what was soon called educational psychology. Schools were not the only site in which the sciences of mind were applied in this period, but the field's increasing focus on learning found an eager audience of teachers, superintendents, and politicians for the next few decades. These clients, in turn, shaped the priorities of psychological expertise and the directions of research as the field matured. One form this influence took was the distillation of psychological theories into practical manuals for teaching and learning. Almost everyone seemed to have advice to offer, in the form of lectures and, soon after, books. While it can be hard to quantify the impact of this pedagogical turn on practices in the classroom, the growth of schools of education and the role of childhood psychology in the training of teachers are easy to see. Psychologists' entry into the classroom expanded their reach into other areas of American life as well.[6]

This expansion changed how psychologists pursued their own projects—the issues they found important and how they went about studying them. One aspect of this change was a new focus on what came to be called "applied psychology," of which work in classrooms was only a part. On the street and in boardrooms, as part of governments and in advice manuals of all sorts, theories built in laboratories and over decades were quickly coalescing into a concertedly practical subfield that put pressure on theoreticians in turn. And not only that: even those whose work was far from "applied" focused, more and more, on learning and problem solving in their studies. The turn to such subjects was not

reducible to the market for books or the lure of public attention. Rather, just as the animal psychologists were finding down the hall (or, at times, in the same laboratories), learning fit the emphasis on measurable, observable phenomena that proto-behaviorists like Thorndike championed at the turn of the twentieth century. Determining if an animal—or a child—had learned a task was easy, at least compared to studies of consciousness that prevailed among those who were more philosophically inclined. Gradually, simple problem solving stood in for more complex mental states—including scientific experimentation.[7]

CHILD STUDY

Much like animal psychology, the early development of child study was riven by debates over methods and evidence. Anxieties about the authority of anecdotes were widespread, as were concerns about something similar to anthropomorphism: namely, the attribution of mental states to children, even infants, because scientists were reminded of their own actions. Evolutionary assumptions were as central to the study of children as they were to work on nonhuman animals, though in slightly different ways. Whereas nonhuman animals were thought to reveal a longer evolutionary history, children modeled in miniature how adults learned to solve problems. Pessimistic observers of phenomena such as childhood insanity argued that children "like brutes, live in the present," but this did not prevent other researchers from treating children as lenses and mirrors. In the minds of these psychologists, childhood development revealed distant aspects of our shared animal past *and* reflected fundamental features of human cognition. Children, like animals, could stand in for almost anything—including scientists themselves.[8]

Just as he was for comparative psychologists, Darwin was a founding figure in the new field of child study. Spurred by a French article on language development that was translated in the journal *Mind,* Darwin responded with a set of observations recorded thirty years earlier, in 1840, about the developmental milestones of his firstborn son. Entitled "A Biographical Sketch of an Infant," the piece is an exhaustive record

of minute behavioral changes. Activities like "sneezing, hickuping, yawning, stretching, and of course sucking and screaming" appeared within hours of his son William's birth, while others emerged more gradually. Though Darwin took these notes before he had fully articulated his theory of natural selection, he was—as we have seen—well on his way, and his interpretation of William's behaviors both at the time and looking back reflect growing enthusiasm for an evolutionary account of human origins and development. Allegiance to his theory led Darwin to read as "instinctive" William's earliest activities, which he thought gave way gradually to experience and, eventually, learning. Emotional development dominated the essay, presaging later work that would become Darwin's *Expression of the Emotions in Man and Animals* (and for which these much earlier notes furnished important material).[9]

Darwin's "Biographical Sketch of an Infant" occupied a developmental stage between the older, naturalistic observations in which he had been trained and newer, experimental studies that were rapidly becoming standard practice in the science of mind and behavior in these years. This meant that Darwin's followers could read his work as observational, experimental, or even both. Battles over the methodological direction of psychology thus played out in child study much as they did in the psychology of animals, not least because many of the combatants were the same. George John Romanes, for example, relied equally on observations of children and nonhuman primates in building his theory of mental evolution and laying claim to the Darwinian mantle. And James Mark Baldwin similarly made his name with *Mental Development in the Child and the Race,* which borrowed methods from comparative psychology for the study of human learning. Romanes and Baldwin saw the use of children for their work not only as convenient, but as necessary. Extrapolating from animal minds to their own meant finding a bridge between the two, a model organism close enough to the motivations and behaviors of nonhuman animals to enable leaps across the species barrier, but also similar enough to adult humans to enable them to complete the comparison.[10]

Children fit the bill. On the one hand, their behaviors from a young age manifested what the psychologists studying them saw as "savage"

energy, uncontrolled and—some imagined—untainted by the manifestation of willpower that came only later in development. Exuberance, joy, and a whole host of other affective states were just what it meant to behave and think like a child. Science, if it could tap into those qualities, would be even closer to nature. On the other hand, the gradual development of the capacity for self-control provided an accelerated model of how human society may have emerged over the course of evolutionary history. Science was not all fun and games, after all. It was distinguished from other ways of thinking by its combination of playful experimentation with grueling rigor. Balancing energy and control, enthusiasm and attention to detail, science was (supposed to be) the best of both worlds, childlike and mature at once. In their exuberance *and* their growing ability to channel it, children stood in for precisely the virtues of equilibrium toward which theorists of method and scientists of mind had been driving for a few generations.

Psychologists' effort to ground this balance in their study of children comes through most clearly in their fascination with the topic of play. Linked by Darwin and others to the universal pursuit of pleasure, play seemed like the perfect activity to connect animals and humans. "I was at first surprised at humor being appreciated by an infant only a little above three months old," Darwin reflected, "but we should remember how very early puppies and kittens begin to play." The instinct for playmaking exposed, to Darwin, an "aesthetic feeling" in animals that presented it. Though he did not cite it, Darwin's take on playmaking reflected one of Alexander Bain's early essays, on toys. Bain thought that toys revealed "a passion for handling," and that playing with them kept the minds of children and adults alike limber. For Bain, associationism explained the pleasures of play, as the experience of novelty (with a new toy) was recalled each time it was confronted again. Because they were more open to this kind of experience, children enjoyed it more: "With us [adults], reason constrains the mind into certain limited channels, and though our faculties are stronger, and our Past more copious than the child's, yet the child probably riots among coincidences, and they already experience pleasures of the Past, more profusely than we do." As in his account of "trial and error," Bain invoked play as an explanation for

the interest we take in certain things—the driving force in the learning process.[11]

Darwin layered an explicitly evolutionary interpretation over this view of play. Bain's "toy principle" was deeper than the impulse to play or laugh, bigger than the behavior of any particular child. Darwin argued that what was true of the individual child's play was true of the species. The appreciation of beauty and the exercise of the imagination were connected, for both the single child and the larger group, to natural or sexual selection (or both). After all, if play was as ubiquitous as it seemed, it had to entail some advantage for either survival or reproduction. Its advantage could be atavistic or current, a relic of the past or a tool of the present. Bain's "passion for handling" did not provide a strong enough rationale for the depth Darwin observed in the "aesthetic feeling," given how widespread behaviors associated with it were. And where Darwin hinted, others staked careers, transforming the evolution of play and its relationship to cognition into a central question for child study—and thus, for psychology—after Darwin.[12]

One influential account of play's utility came courtesy of a German psychologist named Karl Groos. Like Romanes and others in the period, Groos split his most famous work into a first book on animals and a second one on humans. Rather than focus on mental evolution in both groups, Groos zoomed in on one aspect of their relationship: play. He located the advantages of play (for both human and nonhuman animals) less in the past, as a record of milestones reached, and more in the future—as forward-looking. According to Groos, play let animals practice new activities—such as fighting—that were essential to survival later in life. When puppies play-fight within days of being born, they are acting instinctively *and* learning non-instinctive behaviors in the low-pressure environment of the family. The randomness and creativity we associate with play were, for Groos, neither the by-products of the imagination nor the chance occurrences of individual animal development. Rather, the accidental nature of playmaking was precisely the point: play emerged from what Groos called "experimentation" (*das Experimentieren*), a process that built spontaneity into development, giving rise to

everything from play in the young to the more mature attainments of art and—tellingly—science.

The Play of Animals and *The Play of Man* appeared in English in 1898 and 1901, just a few years after their original publication in German. Both were translated by Elizabeth Baldwin, the wife of the psychologist James Baldwin—who provided introductions and editorial additions to each book. It was the link between animals and humans, between roughhousing and science, that attracted Baldwin to this theory of play. As Groos put it in the second volume: "Veritable thirst for knowledge, with its unappeasable questioning, gradually develops from this [experimentation], making without difficulty the transition from the realm of play to that of genuine scientific investigation." Orienting the play instinct toward the future strengthened links between imitativeness in nonhuman animals, games played by human children, and the creative dimensions of adult human reasoning. And this was what made Groos's theory so enticing for Baldwin, who was busy making his own case for the connection between behavior and heredity, in the form of what he called "organic selection" (later termed "the Baldwin effect"). Groos cited both Baldwin and Morgan favorably for their work in the area, which only heightened Baldwin's enthusiasm for what he referred to in his introduction as the "practice theory of play."[13]

Not everyone was so enamored. Stanley Hall, then the president of Clark University and eager to shore up his power in the field, called Gross's theory "partial, superficial, and perverse." Rather than pointing ahead, Hall thought, play unearthed the past. "True play never practises what is phyletically new," Hall insisted, adding: "In place of this mistaken and misleading view, I regard play as the motor habits and spirit of the past of the race, persisting in the present, as rudimentary functions sometimes of and always akin to rudimentary organs. The best index and guide to the stated activities of adults in past ages is found in the instinctive, untaught, and non-imitative plays of children which are the most spontaneous and exact expressions of their motor needs." Play was a relic. "Thus," Hall concluded, "we rehearse the activities of our ancestors, back we know not how far, and repeat their life work in summative

and adumbrated ways." The child's mind, which Bain regarded as a mystery (because a child is not a reliable narrator of subjective experience), was turned into the key to adult cognition. A child's mental development was a window into the past. "It is reminiscent, albeit unconsciously, of our line of descent," Hall wrote, "and each is the key to the other."[14]

Child psychology was more than fun and games for Hall. Widely known (and just as widely reviled) for his relentless self-promotion and polemical tone, Hall was an evangelist for his personal take on evolutionary theory and scientific psychology. Like both predecessors and contemporaries, Hall's interest in evolutionary approaches to the mind was grounded in a search for balance. In his case, scientific psychology was an answer to questions Hall developed as an undergraduate interested in philosophy. Fondness for Romantic literature and, soon after that, the philosophy of John Stuart Mill left Hall looking to make room for intuition, inspiration, and instinct in an account of reasoning he and many others adopted from Kant in the middle of the nineteenth century. Eventually finding his way to Hegel, and thus to what felt like a natural way of balancing reason and understanding, Hall settled on psychology as a means of translating a calling for philosophy into the kind of concrete problem toward which he tended to gravitate. With this idea already in place, he decided to pursue an advanced degree in the science of the mind under a rising star in the study of physiology and psychology at Harvard: William James.[15]

The first recipient of a PhD in philosophy at Harvard (and of a PhD in psychology anywhere in the United States), Hall soon achieved what his mentor had not: a stint in Wilhelm Wundt's laboratory at Leipzig, that calling card of method for American psychologists in the late nineteenth century. Having founded an experimental laboratory at Johns Hopkins upon his return (the priority of which, relative to those at other universities, Hall would spar about for the rest of his career), he trained a cohort of "new psychologists" first as a professor in Baltimore and, after 1889, from the president's office at Clark University. The term Hall would eventually adopt for his approach to the mind sciences was "genetic psychology," by which he meant both its evolutionary framework

and his insistent focus on development (from stage to stage in human life) as the key to uncovering those changes. While he began as a champion of the laboratory, Hall soon turned away from the methods of his training, preferring the questionnaire—and, gradually, statements so general that they were not conducive to empirical elucidation at all.[16]

Even before he graduated, Hall was dissatisfied with American higher education and eager to rethink it along (European) psychological lines. In a letter to *The Nation,* he pointed to the "application of scientific methods in psychology by Spencer, Lewes, Lotze, Wundt, and others," as opposed to what he deemed the American impulse "to tell *what* to think, [rather] than to teach *how* to think." How, rather than what, was the way forward. Hall's sense of inferiority was heightened in Germany. By 1878 he followed up his earlier critique with a celebration of Wundt, which *The Nation* printed anonymously. "The breadth of the field which Professor Wundt has opened to the student of philosophy," Hall wrote, "[and] his acquaintance with and vigorous criticism of Mill, Spencer, Bain, Darwin, etc., . . . indicate more, perhaps, than the writings of any of his contemporaries the direction which philosophical thought is likely to take during the next decade." He called it "The Philosophy of the Future," and he meant it. The next year Hall returned to his earlier topic, concluding that the United States was "yet too young" for philosophy. "The minds of business and working men," as Hall characterized his countrymen, ". . . have short, plain, and rigid methods of dealing with matters of pure reason or of faith."[17]

Although Hall believed that Americans fell short in philosophy, he had hope for science in the country. Evolutionary theories remained controversial in certain European nations, but there was no such problem in the United States (or so Hall thought). Openness to evolution, too, he attributed to youth. Sometimes it got out of hand. "In a country of such remarkably rapid development as our own," he wrote, "where the ploughboy is never allowed to forget that he may become a millionaire or even President if he wills it earnest enough, the catchwords of evolution often excite an enthusiasm which is inversely as the power to comprehend its scope and importance." Americans were like enthusiastic children, often abandoning "the patient mastery of scientific details."

Still, there was hope in their energy. The best that American science writers had to offer, according to Hall, were the essays Charles Peirce had just published in *Popular Science Monthly* on the logic of science—"Illustrations of the Logic of Science." Hall read Peirce's essays as promissory notes for an American synthesis, one in which science was the culmination of mental evolution—and one toward which Hall's own work would have a lot to contribute. What Hall saw in Peirce was a blueprint for a new way of thinking, practiced in an evolutionary key, to take over American education and bring the national mind to maturity. Science, specifically Hall's vision of science, was the key to doing that.[18]

Hall cast his own intellectual development in the same terms in which he framed the state of American education. He turned personal experience into a call to arms: "I believe that no one has much knowledge of the inner workings of his own soul until he has served an apprenticeship in the psycho-physical laboratory . . . [which] lays bare the geology of the soul . . ." Classroom conduct was a kind of excavation: "Into the well conducted seminary all the hereditary influences from all the council camp fires and stories of our forebears, a little of the esoteric spirit of all the secret organizations of savage life from the immemorial past have gone and in it they find one of their highest expressions in the modern life of culture." Classroom discussion, like the child's mind, was a window into our past, a vision of the history of struggle and progress that culminated in the practices of scientific experiments. "There is a vagueness and mysticism about youth that is inevitable at the time when sentiment is ripening into thought and reason," Hall concluded, and it was this energy that he sought to capture in his teaching.

Just as Peirce had done, Hall invested his chosen field with almost spiritual significance: "psychology raises the interest in life which all feel to a higher potence and intensifies the desire to see, know, touch it at every point, to enlarge our experience as far as possible toward becoming commensurate with that of the race." Where Peirce thought of his logical method as "his bride," Hall was "smitten with a pedagogical passion of helping young men." This blend of the personal and the professional, of the pedagogical and the psychological, was there from his earliest essays. Critical letters in the 1870s, celebrations of the "new psychology"

in the 1880s, and more prominent pieces on the state of the field in the 1890s all made matters of mind and method not just momentous, but almost mystical. At times, his high-flung rhetoric comes off as self-aggrandizing (if not a bit empty), but at others it reveals a commitment to making a science of the embodied mind central not just to the study of philosophy, but also to the practice of teaching and the reality of living. The important thing to note is that, while his zeal is striking, his focus was not exceptional: psychologists were bent on using their tools to intervene in American classrooms throughout the late-nineteenth century.[19]

A glance at Hall's publication record reveals a careful balance between research on what he called "the contents of children's minds" and efforts to put such research into practice in the classroom and beyond. Gradually Hall's pedagogical and psychological work blurred together, such that by the 1890s titles like "Child Study as a Basis for Psychology and Psychological Teaching" and "The New Psychology as a Basis for Education" start to become a rule, not an exception. Some psychologists saw their duties as researchers and as educators coming apart in this period, but Hall sought something like the opposite: an inextricable link between his theories of mental evolution and the recommendations he made for teaching. This relationship between psychology and pedagogy had a political edge, both in the small-p sense (Hall was attempting to consolidate support for his vision of the field) and in the big-P sense (he was trying to make the political utility of his work more apparent). This eagerness to combine psychology and pedagogy in a new politics of method turned Hall into one of the most prominent scientists of his day.[20]

In part, Hall was able to put his child-centric view of science to work by controlling the organs of publication. He founded the *American Journal of Psychology* in 1887 and, in 1891, *Pedagogical Seminary.* A year later he was named the inaugural president of the American Psychological Association, for which the *AJP* was made the official journal. All of this happened around the time Hall became the president of Clark, a combination of events that enabled him to get his students' results—and his vision for the field—into the hands of most of the young

field's practitioners in short order. This is part of the reason Small's experiments on rats and Lindley's studies of children, conducted with Hall's theories in hand and under his supervision, reached such a broad audience despite the authors' comparative youth and inexperience. Though his entrepreneurial facility existed in tension with his interpersonal difficulties—Hall made as many enemies as he did friends through his efforts to promote his ideas and dominate conversations in the field—his enthusiasm for application put Clark on the map. Hall's insistence that his students spell out the implications of their research meant that even when colleagues at other universities disagreed with their results, his students' projects were taken seriously and played an outsize role in the child study movement.[21]

Hall's peculiar ability to both influence and infuriate is nowhere clearer than in the response to his two-volume *Adolescence.* Published in 1904, the book—like Darwin's *Origin*—is presented as an abstract of a magnum opus that never appeared. Instead, *Adolescence* stands in for that grander work, a testament to the range of Hall's interests, his disciplinary ambitions spelled out in the subtitle he chose: *Psychology and Its Relations to Physiology, Anthropology, Sociology, Sex, Crime, Religion and Education.* The book is credited with turning adolescence into an object of scientific study—distinct from childhood on one side and adulthood on the other—as well as introducing the term into wider use. But Hall saw the book as even more than that. Adolescence, he implied in the preface, stood in for the human species as a whole, at least as he found it at the dawn of a new century. "While his bodily form is comparative stable," Hall wrote, "his soul is in a transition stage, and all that we call progress is more and more rapid." What was true of the species was true of the scientist: "The view here represents a nascent tendency and is in striking contrast to all those systems that presume to have attained even an approximate finality." Method, like the human species, was undergoing a transition; psychology was moving from one phase to another. What better way to reveal its nature, to inaugurate "the long-hoped-for and long-delayed science of man," than by studying the stage of mental life that best corresponded to that methodological moment: the adolescent?[22]

The book's first volume consisted mostly of biology. The second turned inward, to adolescent psychology and behavior. An "unconscious" and "spontaneous" love of nature, Hall argued, emerged in puberty and was essential to science's development. This "first sentimental response" is followed by "popular science," including its history, after which "applied" and "pure" science can be taught to students and, eventually, practiced by them in turn. Throughout the book, Hall insists that learning depends on a genetic understanding of the subject to be taught, both in the sense of its history as a field but also of the stages by which students become capable of thinking in its terms. And after all, these two meanings of "genetic" were one and the same for Hall: adolescent development mirrors the rise of modern science, and only by studying both can you take advantage of the natural energy and interests of the students in your classes. Sadly, Hall reflected, "science is often taught in a way to destroy the love of the very department of nature it should develop. The only corrective," he concluded, "is to introduce evolution as a conscious method, a goal to which everything focuses to a great unity." The theory's wide applications and deep explanatory power are perfectly suited to the needs of adolescent minds: it combines the unconscious with the conscious, the natural with the artificial, in just the balance developing minds are seeking. This had been Hall's own experience of adolescence, and he wrote it onto the species. The solution for science and for adolescent longing was the same: a new method, modeled on the process of evolution.[23]

Child study, in Hall's hands, was not just a new window into the adult mind, nor was it only a lens to focus our shared history. It was also crucial to Hall's broader disciplinary agenda: turning psychology into an obligatory passage point for public and political discussions. In Hall's hands, the mind of the child, and especially of the adolescent, became a means of remolding science as a (natural) political tool modeled on the practices Hall and his students were already pursuing. To make science seem like the obvious starting point for broader discussions, it had to exceed or avoid the issues and differences that divided those involved in such conversations. One way to turn it into something natural was, as we have seen, to find science's roots beyond humans—and thus

beyond politics. Hall's students pursued this line of study, building on work in animal psychology to remake both psychology in particular and science in general. Hall, on the other hand, extended back in time, casting child development as the key to science's history. Both ways worked: whether it was animal or child, laboratory or classroom, present or past—Hall and his students helped turn science into an organic process on which a divided society could depend for new directions.

Of course, turning science—or anything else—into a natural phenomenon does not void it of moral significance, even if that is the goal. A glance at the moral weight we assign to human life, to learning milestones or childhood trauma, is a reminder of the unavoidable normativity of any such effort. These moral dimensions were not particular to child study, of course, but there was something about child psychology that brought them to the fore. If child development made the hidden values of science clear, it was just a first step to recognizing them in other places. Hall was revealing, in his work and that of his students, a latent effect of turning science into a natural evolutionary process: what seemed like *descriptions* of thinking very quickly become, in the hands of psychologists and in the classrooms they entered, *prescriptions* for thinking—scientific or otherwise. By introducing "moral kinds" into the language of science, by subjecting social phenomena to scientific observation, child study highlighted the continued political salience of matters of method.[24]

REFLEX ARCS

During his brief stint at Hopkins, Hall worked closely with Charles Peirce, alongside whom he taught a young graduate student named John Dewey. Given that he studied with William James at Harvard as well, Hall's career displays an extraordinary centrality to American intellectual history for someone who is so much less familiar than his more famous peers. Hall's contested place in the period was owed, at least in part, to his personality: awkwardness almost seemed like a conscious program at times. Hall routinely pushed away mentors, colleagues, and

students who got too close and drew distinctions where others might have formed coalitions. Some historians have followed Hall's lead, accounting for his institution building as though it was separate from the main developments in science, philosophy, and the other fields with which he engaged from the 1870s through his death in 1924. Even Hall's famous invitation to Sigmund Freud, which led to the Austrian analyst's only visit to the United States and propelled him to wide recognition, has been framed as the passion project of an American impresario rather than community building among human scientists—not least because Hall presented himself in these terms at the time.[25]

As is so often the case, however, a closer inspection reveals something more complicated. Hall's eagerness to distance himself from his peers stemmed as much from similarities as from differences. This is perhaps clearest when it comes to the relationship between Hall's research, including his reflexive attention to method, and that of his erstwhile graduate student, John Dewey. Long before he became the elder statesman of the "high tide of American liberalism," Dewey forged a path from philosophical idealism to psychological naturalism. After graduating from Hopkins, Dewey pursued this line of research first at the University of Michigan, then the University of Chicago, and finally (after 1904) from a perch at Columbia University. Dewey's status as an American icon has been cemented in endowed chairs at each of the schools at which he taught, hundreds of books dedicated to his work, and the continued currency of his ideas among academics, educators, and activists. Though often hard to comprehend—Oliver Holmes famously likened Dewey's writing to how "God would have spoken had He been inarticulate but keenly desirous to tell you how it was"—Dewey's publications played a key role in cementing science's new cultural authority in the Progressive era.[26]

Looking back in 1930, Dewey gave a name to a transition he felt he had undergone in the 1890s: "From Absolutism to Experimentalism." Fascinated by German idealism, which he picked up first as a student at the University of Vermont and then at Hopkins (not from Hall or Peirce, but instead from the school's third instructor in philosophy, George Sylvester Morris), Dewey's early interest in psychology was spurred by

Hegel, not Mill. What most captivated the young New Englander was an image of what Hegel called the "Absolute Idea," a construct that seemed to unify what Kant had separated into things-in-themselves *(noumena)* and things-in-use *(phenomena)*. To Hegel, this unification was "the sole subject matter and content of philosophy." Dewey was far from alone in his fascination with grand ideas like "the Absolute": across Europe and, perhaps especially, in Britain and the United States, a popular vogue for idealism held a great deal of sway in the late-nineteenth century. While James was famously skeptical of the movement, Hall had begun as Dewey did: animated by Hegelian idealism. Many contemporaries would have shared "the sense of divisions and separations that were," Dewey later recalled, ". . . borne in upon me as a consequence of a heritage of New England culture." Idealism, or what Dewey called absolutism, was a common response to those conditions.[27]

"Absolutism" named Dewey's idealistic roots, but "experimentalism" was what he was groping for in the 1890s. Still, he struggled to say exactly what that goal entailed, even many years on. Experimentalism, according to Dewey, was "too much the self that I still am and is still too much in process of change to lend itself to record." Part of its meaning is captured in the different names Dewey gave to it over his career. The most famous is "pragmatism," though James was fonder of the name than Dewey, who preferred "instrumentalism." (Peirce, too, was unhappy with the label, ultimately opting for "pragmaticism" to differentiate his mature views from what he viewed as James's "kidnapped" version.) Other "-isms" Dewey applied to his work included "functionalism," "naturalism," and, of course, "experimentalism." Each encompassed a phase of Dewey's life and, he felt, of intellectual history; both his own development and broader philosophical stages were "unstable, chameleon-like, yielding one after another to many diverse and even incompatible influences." For Dewey, "absolutism" was solid and "experimentalism" was flexible. The latter term picked out the shifting nature of mind and method as he and others experienced them. Dewey's many efforts to name it were themselves experimental.[28]

The transition from absolutism to experimentalism, as Dewey recalled it, occurred in 1891. The precise moment of rupture was

crystallized in an essay he published that year entitled "The Present Position of Logical Theory." Dewey did not use "logical" in the sense that his onetime teacher Peirce had—far from it. Dewey sought what Peirce now denied was possible: a logic rooted in psychology, a science that could "determine the exact and concrete relations of subject and object, individual and universal within consciousness." While in his Hegelian phase, in the 1880s, Dewey saw the individual and the universal as one and the same, tying himself in knots with claims like "individual consciousness is but the process of realisation of the universal consciousness through itself." By 1891, with his ideas "undergoing reorganization," Dewey tried to shed these idealistic overtones while holding onto a reflexive link between psychology and the practice of science more generally. Still defending Hegel as "the quintessence of the scientific spirit," Dewey's "The Present Position of Logical Theory" marked a subtle shift away from the "Absolute Idea" toward "the inner anatomy of the realm of scientific reality." Logic, in his view, was "the theory of scientific method," its subject matter no longer fundamental or transcendental, but basic: "the various typical methods and guiding principles which thought assumes in its effort to detect, master, and report fact." Science was gradually being grounded.[29]

Logic was a human science in two senses. First, its subject matter was human: the real, lived efforts of human thinkers. They were scientists, at first, but Dewey soon extended the circle to include all cognitive practices—to grapple with any thinking he could find. In this regard, logic and psychology blurred into one another in just the ways anti-psychologists like Peirce were decrying in those decades. Second, it was not only the subject matter of logic that was human: it was the subjects, too—the people putting its methods into practice. This may seem trivial, given that all science was "human" as such, but recall that Dewey was specifically interested in the reflexive potential of what he called "experimentalism." As a science in the experimental sense, logic reacted to its own results; as new insights about thinking emerged, they redefined what any practitioners were capable of and how they might best go about achieving more. When inquiry was the focus of inquiry, when reflexivity was the norm of a scientific field, a peculiar kind of

stable instability began to set in. Every new claim or new way of thinking shifted the conditions of possibility for future claims. Dewey, more than most, saw this not as a risk or a downside, but as essential to living experimentally in the modern period.

Dewey tested this scientific reflexivity on one of the icons of the "new psychology": a phenomenon called the reflex arc. Embodying the ideal of measurement and observation that was taking hold across the human sciences at the end of the nineteenth century, the reflex arc stood in for decades of laboratory attention to the precise moment when the mind reacted to an external stimulus. What James derisively called "the *elements* of the mental life"—the mental states that associationists and others were removing "from the gross results in which they are embedded, and as far as possible reducing them to quantitative scales"—were points of pride for laboratory psychologists. This was, ironically, the world James had helped bring into being in the 1880s and in which Dewey had been trained. But like James, Dewey wanted to complicate this emphasis on the mechanical and the objective, the separable and abstract, that had consumed the field. So by attacking the very idea of the reflex arc, insisting that it was complex and organic rather than simple or at least simplifiable, Dewey was going after the heart of what made psychology seem like a (potential) science to so many around him.[30]

Doing so meant wading into a standing debate over what exactly reaction times were. On one side was Edward B. Titchener, the champion of what he called "structuralism." Titchener's goal was to describe what he saw as the universal features that underlay all cognition, or what he referred to as "structures." His preferred method was introspective, though not (he insisted) in the old sense of the term. Titchener's introspection was "objective" and "experimental," careful self-assessment that was centered on the "simple reaction-time," or the measurable interval between a sense impression and a movement it elicited. Against Titchener's structuralism, a set of avowed "functionalists" emphasized the "how" over the "what" of mental life. While Titchener saw the reaction-time as a universal unit, his antagonist James Mark Baldwin claimed he had broken it down into different "types." In other words: reflexes were not universal. The dispute was arcane, but at root it was methodolog-

ical: "The reaction-time experiment," said Baldwin, "becomes of use mainly as a *method.*" Their disagreement boiled down to "the method of science in general," what Baldwin called science's "machinery." According to Baldwin, Titchener had some outdated machinery; it had blinded him to the fact that science needed to evolve.[31]

Functionalism, according to its proponents, was the next stage of that evolution. Proving it so fell not to Baldwin but rather to a psychologist at the University of Chicago named James Rowland Angell. Along with his co-author, Addison W. Moore, Angell sought to "combine and reconcile some of the principle contentions of both sides of the 'type' discussion" in the form of what they called a "dynamo-genetic" view. They sought, in other words, to turn functions into a set of explicitly evolutionary capacities. "Taking the simple reaction as the type of voluntary action in general," they wrote, "and voluntary action as action under the direction of attention, it seemed that the key to any explanation adequate to all the facts, the individual peculiarities and the effects of practice, must be found in the functions of attention and habit in their relations to each other." The difference between stimulus and response was "not one of *content,* the stimulus being identified with the ear, the response with the hand, but one of *function,* and both offices belong equally to each organ." Attention had been redefined "as the adjustor, the mediator" of embodied cognition.[32]

The dispute over reactions was soon a clash between competing "schools": structuralists and functionalists. As so often happened, their differences boiled down to methods of study, not theories of mind. For Titchener, structuralism was about preserving introspection as a valid way of reading minds. In his laboratory at Cornell, and those on which it was based at Leipzig, this meant continuing to rely on interactions between experimental subjects who registered internal experiences using instruments in pursuit of objective measurement. While nothing was stopping the functionalists from introspecting, they tended to observe the behavior of others rather than their own minds. This distinction became clearest among animal psychologists, who were soon overwhelmingly functionalist in their approach. On Titchener's view, animals could never reveal the structures of the *human* mind—hence the continued

reliance on introspection. For Morgan and others, nonhuman animals were as legitimate as colleagues for the analysis of functions in the laboratory. The rapid rise of comparative psychology around 1900 went hand in hand with the success of functionalist approaches to the mind, not least because Titchener's structuralism was predicated on a practice—introspection—that quickly became impracticable.[33]

Yet, while the debate grew into something of a scandal for the new field, few observers recognized how the acrimonious rhetoric of Titchener, Baldwin, Moore, and Angell papered over a fundamental agreement: that there *was* a reaction-time, a measurable and meaningful unit, and that psychology could be based on quantifying its existence in the appropriate way. Structuralists and functionalists both claimed the label "experimental" for their work; both groups emphasized calibration and control. One, the structuralists, directed these ideals inward toward the self; the other, the functionalists, looked outward, to other minds. While they disagreed about where to look, they agreed that the objects of one another's studies *did exist.* Reaction-times, as Angell and Moore insisted in their effort to combine the two approaches, had structural and functional aspects. Whether you came from one school or the other, you agreed that psychologists studied a set of interlocking phenomena that could be visualized in much the way that physiological phenomena had been studied by the scientists who helped train them. What looked, on one level, like an acrimonious dispute, was actually a fundamental agreement on another.

Or so it seemed. Angell and Moore's diplomatic efforts were not the last words in the fight over the "new psychology," nor was their essay the founding document in functionalism as it came to be understood over the next decade. That honor falls to two of Angell's mentors: James, under whom he did his doctoral research at Harvard, and Dewey, who had first pointed him toward James as an undergraduate and who was now his colleague at the University of Chicago. The impact of James's *Principles* and Dewey's early articles was vast and varied, but contemporaries tended to assign pride of place to their respective roles in starting and solidifying functionalism as the main school of American psychology by the end of the century. Angell and Moore, for example,

credited Dewey and another colleague with their initial inspiration: "we are indebted," they confessed in a footnote, "to Professors Dewey and G.H. Mead, for suggestions without which the following interpretations would not have been reached." And, if their essay articulated a halfway point between structuralism and functionalism, it was Dewey himself who pushed the field into functionalism for good. In the same year Angell and Moore published their landmark essay, Dewey brought out a piece that soon became the school's founding document.[34]

"The Reflex Arc Concept in Psychology," published in 1896, remains Dewey's most famous essay as a psychologist. The piece was also foundational to his later work in other fields. In it, Dewey argued against his own title—and, in doing so, spoiled the alliance his students had tried to forge that same year. His argument was simple: "the reflex arc idea, as commonly employed, is defective in that it assumes sensory stimulus and motor response as distinct psychical existences, while in reality they are always inside a coordination." In other words, "stimulus" and "response" were not so much *separate*—as most psychologists had assumed, even in the recent studies of reaction-times by his friends and students—as *separable*. It was scientific convention that held the two apart. In the real world, stimulus and response were "functions" of a larger process: "It is the coordination which unifies that which the reflex arc concept gives us only in disjointed fragments. It is the circuit within which fall distinctions of stimulus and response as functional phases of its own mediation of completion. The point of this story is in its application." But that application, Dewey concluded, would have to wait for "a more favorable opportunity" to come around. For now, functionalism was largely reactionary, a set of claims about how other approaches to the mind fell short.[35]

Readers would not have to wait long, however. Dewey's critique of the reflex arc was just the beginning, and he and his students soon began to march on behalf of functionalism in all sorts of venues. Two years later, when he published his essay "Philosophical Conceptions and Practical Results," James brought their approach to a wider audience. Angell wrote immediately to say how much he liked the attention—and in doing so, pulled James into the functionalist fold: "I was greatly

interested in your presentation of Peirce's notion of 'pragmatism,' for it fits very closely with the life-long bias of my own untutored thinking and it is in many respects surprisingly like what Dewey is driving at and upon this I was of course more or less brought up." Angell had in mind the work Dewey put into his "Reflex Arc" paper, as well as his own on the coordination of habit and attention. A few years earlier, this argument would have surprised James. He had found Dewey's *Psychology*—a textbook published in 1887, during the high tide of his Hegelianism—"a great disappointment," for example. Their early exchanges had consisted largely of Dewey's (failed) attempts to convert James to Hegel. Given James's well-known scorn for Hegelian notions, Dewey had to learn to suppress it before James took him seriously.[36]

And that is precisely what happened. By the time of the "Reflex Arc" article, James was primed to see the connections Angell implied in his letter. And when, a few years later, Dewey and his students and colleagues at Chicago published a collection of essays under the title *Studies in Logical Theory,* James understood it to be a sign of the times. Endorsing the book in the *Psychological Review,* James wrote: "Chicago has a School of Thought!—a school of thought which, it is safe to predict, will figure in literature as the School of Chicago for twenty-five years to come." Though he never named it as such, James's summary made clear that he saw Dewey's work as a *functionalist* critique of the cleavage between thinking and action, which is just what Angell implied when he wrote him a few years earlier. James's writings had moved in the same direction, both in what he called his "radical empiricism"—a way of breaking down the barriers between mental and physical phenomena—and in ongoing research into occult phenomena under the umbrella of "spiritualism." James was the consummate boundary-crosser, searching for the limits of the self across lines laid by the guardians of discipline and propriety alike.[37]

To James, functionalism was a matter of method. He shared with Dewey an evolutionary view of the mind that informed a new way of thinking about science. After all, if humans are just one more organism doing its best, then what kind of warrant did their claims really have? It was in responding to this dilemma, James thought, that his view came

closest to Dewey. Both, he argued, were functionalists, and for them "a fact and a theory have not different natures, as is usually supposed, the one being objective, the other subjective. They are both made of the same material, experience-material namely, and their difference relates to their way of functioning solely. What is fact for one epoch, or for one inquirer, is theory for another epoch or another inquirer. It is 'fact' when it functions steadily; it is 'theory' when we hesitate." James and Dewey both used psychology to redefine fundamental scientific categories. Most famous (or infamous) was a new definition of truth, most closely associated with James but which he credited first to Peirce and then, in his review, to Dewey: "'Truth' is thus in process of formation like all other things." It was the task of the psychologist and the philosopher alike to catch truth in the act of becoming. Doing so required a different sort of "School."[38]

WORKING HYPOTHESES

Dewey knew just how radical it was to critique the reflex arc in the 1890s. After all, psychology was already a mess—especially in the United States. Competing approaches were pulling it in opposite directions, with practitioners increasingly torn between "pure" and "applied" methods in their shared field. Theoretical and methodological chaos called out for something to stitch it all together. Dewey recognized this need at the start of his "Reflex Arc" paper—only to carry on with his radical critique. "That the greater demand for a unifying principle and controlling working hypothesis in psychology should come at just the time when all generalizations and classifications are most questioned and questionable is natural enough," he wrote, adding: "The idea of the reflex arc has upon the whole come nearer to meeting this demand for a general working hypothesis than any other single concept." So why deconstruct a concept with so much riding on it? Because the reflex arc failed to live up to the hype: "in the idea of the sensori-motor circuit," Dewey argued, "conceptions of the nature of sensation and of action derived from the nominally displaced psychology are still in control." The problem was

not that proponents of the reflex arc had gone too far in basing the "new psychology" on it; the problem was that they, and the concept, had not gone far enough. The field desperately needed a new foundation.[39]

This search for a new working hypothesis began in an unlikely way: a chance encounter with a "newspaper man." While on the faculty in Ann Arbor, Dewey met a radical editor named Franklin Ford who had recently moved back to his home state of Michigan from New York City. To Dewey, Ford represented the prospect of turning philosophical and psychological theories to account in the real world. While Dewey was drawn to idealistic philosophy out of "some sort of instinct," Ford had been "led by his newspaper experience to study, as a practical question the social bearings of intelligence & its distribution [and] had found idealism." In other words, the two men had found their way to one another, and to the nexus of theory and practice, by moving in opposite directions. Ford held Dewey in thrall. Dewey's letters in these years were full of allusions to Ford: to his personality, his energy, and above all his orientation toward practical social problems. Dewey was so taken by his new friend that, in a letter to James, he vented an almost millenarian optimism: "I believe that a tremendous movement is impending when the intellectual forces which have been gathering since the Renascence [*sic*] & Reformation shall demand complete free movement, and, by getting their physical leverage in the telegraph & printing press, shall through free inquiry in a centralized way, demand the authority of all other so-called authorities." This focus on authority would have been familiar to James, but Dewey had found a figure in whom he felt it was personified: Franklin Ford.[40]

Dewey's enthusiasm culminated in a strange project. Called *Thought News,* it was an abortive attempt to turn Ford's focus on philosophy's practical side into something tangible—into, as Dewey put it to James, "inquiry as a *business.*" *Thought News* was supposed to be just what it sounded like: a periodical that turned the thinking process into a commercial product. According to a write-up in Michigan's *University Record,* the goal was to use "philosophical ideas in interpreting typical phases of current life." Despite these ambitions, however, *Thought News* never materialized. It was satirized in the press almost as soon as it was

announced, and no issues ever appeared. Today, we have very little evidence of the project or its demise, but what we do have suggests that, either before or during its early collapse, something soured between Dewey and Ford. Dewey called Ford a "scoundrel," and seems to have lost track of him soon after their plan fell through. Decades later, he would remember *Thought News* as "an over-enthusiastic project," a symptom of youthful yearning within the constraints of the academic life he was living. To the relief of James and others, Dewey soon turned away from the organic idealism that he had desperately attempted to wed to the commercial interests Ford represented. As Dewey would have put it, his thinking evolved.[41]

But like his youthful Hegelianism, Dewey's dalliance with Ford left more than a mark on his mind going forward. Even if his aim to turn philosophy into a business (of a sort) was never fully realized, Dewey whet his appetite for the kind of practical, public-oriented projects that would become a defining feature of both his philosophy and his career. What he saw in Ford, beneath the grandeur of expectations and the need that drove him to them, was the prospect of making our ideas matter—not just in the sense of secure employment, or even changing the minds of students, but in a broader political sense. Ford may have been a phantom, but his commitment to turning ideas into "intelligence" by putting them to work struck a chord with Dewey and some of his colleagues in Ann Arbor—so much so that after *Thought News* evaporated, he and other members of the philosophy department were on the lookout for another opportunity to have an impact on the wider world. To them, this meant more than spreading the results of their research beyond the academy or testing hypotheses in the real world. It meant *making* those theories out there, adapting to the circumstances of application. This was what Dewey meant by a working hypothesis: he wanted to find one "out there," at work.[42]

And this is precisely what Dewey did—not in Ann Arbor, but in Chicago, where he soon joined a new university endowed by John D. Rockefeller and built on land donated by Marshall Field. Riding the wave of university reform that spawned Johns Hopkins and swept up Harvard and other older colleges, the University of Chicago was soon producing

more PhDs in the sciences than any other American university. Thanks to the ambition of William Rainey Harper, its first president, the school quickly assembled a word-class faculty, largely by poaching from peer institutions. Harper's primary target was another new university: Clark, where Stanley Hall lost a huge proportion of the professors he had painstakingly assembled in what was soon called "Harper's Raid." Just as crucial as this recruitment binge to the shape of the new university was the specificity of its setting on Chicago's South Side at the tumultuous close of the nineteenth century. Torn apart by labor unrest and enlivened by a social reform movement, both of which were responding to rapid changes in industrial society, the city was primed for just the kind of engaged scholarship the abortive *Thought News* project was meant to embody. From Eugene Debs and the Pullman Strike to Jane Addams and the settlement house movement, Chicago and its new university were an ideal setting for rethinking the relationship between science and society.[43]

This is where Dewey set up shop—or rather, school. For it was the chance to work with kids that drew Dewey to Chicago. He had tried his hand at child study already, first with Hall at Hopkins and then, off and on, during his time at Michigan. But it was the prospect of expanding this area of focus, in addition to the desire to reach a wider audience (as exemplified in the Ford episode), that had his attention at the start of the 1890s. Just as Hall learned in his move from Hopkins to Clark, the ability to control the administration of one's own research and to trespass at will across the boundaries between various sub-fields was more than a luxury for researchers of Hall or Dewey's temperament. It was a necessity, if one was to control the application of one's own work to the areas in which it might have an effect. In a popular essay published just before he left Michigan, Dewey argued that the enforced separation of theory from practice was causing a "chaos in moral training" that he noticed in the undergraduates he taught: "Here as elsewhere our greatest need is to make our theories submit to the test of practice, to experimental verification, and, at the same time, make our practice scientific—make it the embodiment of the most reasonable ideas we can reach. The ultimate test of the efficacy of any movement or method is the equal and

continuous hold which it keeps upon both sides of this truth." The prospect of such a testing ground led Dewey to leave Michigan. When Harper's offer came, he later recalled, "one of the factors leading to its acceptance was the inclusion of Pedagogy in the department with Philosophy and Psychology." The "test of practice" would be education.[44]

Dewey arrived at the University of Chicago in the fall of 1894, leaving his family back in Ann Arbor so he could get the lay of the land. Significantly, part of settling in meant arranging for his children to start school in Chicago, something that proved more difficult than he had imagined. Seeking a solution to this most practical of dilemmas, a new idea occurred to Dewey. "There is an image of a school growing up in my mind," he wrote to his wife Alice, ". . . the material & methods for such a school all exist now lying round loose in scattered form." The image was a "constructive" one, in which students would learn by completing manual tasks that would ground "a social training on the one side and a scientific on the other." The "material & methods" to which Dewey referred were, in one sense, embodied in an ongoing education reform movement now centered in the nearby Cook County Normal School, headed by Francis Wayland Parker, who had already made his name as a reformer. In another sense, however, what Dewey meant by "material & methods" were the techniques and results of child study in particular and the "new psychology" in general. In his hands, pedagogy would become a human science.[45]

Part of merging pedagogy together with psychology and philosophy was the emphasis that all three placed on practice, or what Dewey more often called "experimentation." Pitching his idea to Harper, Dewey proposed it as a "complete experimental school" for a reason: the term signaled a scientific mission, one suited to the university's goal of preeminence in an era already dominated by the rhetoric of the laboratory and experimental progress. In addition to securing an education for his children, Dewey was carving out prestigious space for himself in the university and in the broader academic community. Having a school at hand would help in his mission of developing working hypotheses for the field of philosophy. It might not have been quite what he imagined with Ford for *Thought News,* but the rhetoric of experiment clearly

signaled something crucial. Later in the letter to his wife, Dewey made the stakes of the matter clear: "The school is the one form of social life which is abstracted & under control—which is directly experimental, and if philosophy is ever to be an experimental science, the construction of a school is its starting point." Philosophy, psychology, and pedagogy were converging on experimentalism, just like Dewey was. Experiments became how ideas were set to work in the world.[46]

Indeed, experimentalism was more than that: it was *changing* the world, turning every aspect of it into a laboratory. This transformation went in both directions. As Rebecca Lemov has shown, psychologists in the twentieth century succeeded in conquering new terrain for their work: beyond schools and colleges, they gathered data in stores and from polls, calling subjects and going out to find them where they were. The world was a laboratory in the familiar sense, then, with scientists fanning out to collect evidence and turn it into publications. But the other direction held as well: ordinary Americans began to see aspects of their daily lives in terms set by, or tied to, the research conducted by those psychologists. The rise of "experimentalism" as an ideal happened all over the place: in government and literature, in parenting and art. While the expansive sense of science in Dewey's work did not prevail in all these applications, the meaning of experiment was not uniformly reduced to white coats and sterile laboratories. Something of the buoyant, boisterous ideal of experimental living that Dewey identified with children lived on in modernist art and poetry, even if the scientific ideals to which such ventures pointed would be replaced by a more static image of experimental practice. Dewey's pedagogical work was part of a much broader, deeply cultural movement.[47]

Late in 1895 Dewey signed Clara Mitchell on as the school's head teacher. Mitchell was an instructor at the Cook County Normal School, which was soon to be folded into the university (as were other local institutions, part of Harper's consolidation of intellectual and political power in the city more generally). The school opened in January, with a dozen students (including, of course, Dewey's children) and Mitchell as the head teacher. Dewey first described the school as a "laboratory" in the context of recruiting Mitchell, telegraphing his interest in devel-

oping methods of effective teaching. Later, he gave the credit for calling it "The Laboratory School" to Ella Flagg Young, another reformer whom Dewey recruited to the cause. Young was a superintendent in the Chicago school system in the 1890s and, in her fifties, became a star student in Dewey's early seminars at the university. After resigning from the schools in 1899, Young accepted an offer from Dewey to supervise instruction at his school. Both Young and Dewey saw the rhetoric of the laboratory as useful, not just in their negotiations with Harper over the school's status, but also as a means of attracting students (that is, students' parents) and teachers to the project.[48]

"Dewey's School" (as it was known) was a laboratory in three senses. The first is the most familiar today: students at the school learned by doing—specifically by doing experiments. This was implicit in Dewey's early focus on construction, which paired mental and manual training. Students learned chemistry through cooking, for example, with "eggs serving as the material of experiment." For Dewey, experiments elicited something natural from within the children themselves: "For the child simply to desire to cook an egg, and accordingly drop it in water for three minutes, and take it out when he is told, is not educative. But for the child to realize his own impulse by recognizing the facts, materials and conditions involved, and then to regulate his impulse through that recognition, is educative." Self-direction was key to Dewey's definition of experiment: if a task involved no sense of purpose or instinctive attraction, it would not suffice. Not a single fact should be taught "except as the child sees that fact entering into and modifying his own acts and relationships." Experimentation, from kids cooking eggs to the discoveries of eminent physicists, was rooted in a reflective impulse, one a proper education in scientific thinking was designed to elicit from every student.[49]

The second sense of the laboratory was predicated on this connection: teachers, too, were supposed to be spontaneous, creative, and adaptive. After all, teachers were human; this way of thinking was supposed to come naturally. "The school," Dewey wrote early on, "has two sides, which of course are the obverse and reverse of the other—the one for the children, the other for the students in the University taking

up pedagogical work." The line between student and teacher was a blurry one. When leading groups of eight-year-olds, the adults in the classroom were the teachers; when reflecting on what they had done and imagining ways to do it better, they were students. This blurriness started in classroom instruction, the methods of which Dewey saw as "ultimately reducible to the question of the order of development of the child's powers and interests." As a specific version of "child-centered teaching," this approach looked not to the whims of this or that child, but to child psychology, to guide pedagogy. "The law for presenting and treating material," Dewey wrote in *My Pedagogic Creed,* "is the law implicit within the child's own nature." Psychology was how that nature was elucidated; so, once again, prescription emerged from description. Because children experimented, and because they did so naturally, the teachers had to be experimental, too. Soon, the thinking went, it would be second nature.[50]

Like his redefinition of the reflex arc, Dewey's reorientation of the methods of teaching was predicated on mental unity. As he put it elsewhere, in an account of the relationship between children's imaginations and their ability to express them: "there are not two sides to the child, an image and its expression; the image is only in its expression, the expression is only the image moving, vitalizing itself." As with students' minds, so with the teachers': the task was reflective adaptation, learning to teach by engaging experimentally with students themselves. Training teachers without this kind of experience, without what he called "practical exhibition and testing" was, as Dewey told Harper in a pitch for the project, like "professing to give thorough training in a science and then neglecting to provide a laboratory for faculty and students to work in." Just as chemistry students learned in the laboratory, so pedagogy students—future teachers—had to experiment firsthand. Like the lessons they taught, classroom practices were "worked out by the teachers themselves cooperatively, with considerable use of the trial-and-error method." Everyone's mind followed the same patterns.[51]

Dewey's third sense of laboratory was the original one he proposed to Harper: the school was *his* laboratory, a place to bring ideas "to the test of practice." Dewey made this clear in early promotional efforts. "The

conception underlying the school is that of a laboratory," Dewey wrote in the *University Record:* "It bears the same relation to the work in pedagogy that a laboratory bears to biology, physics, or chemistry." When he called it "a pedagogical experiment"—he meant it. Even the school's physical aspects were experimental in this sense. In his first budget report, for example, under "Permanent Equipment," Dewey crossed out "Library"—and wrote "Laboratory." As the century ended, Dewey's research reflected his engagement with students and teachers at the school more and more. *My Pedagogic Creed* and *The School and Society* were based on his work there, and both pointed toward integrating the psychological research in the "Reflex Arc" paper with advocacy of what would come to be called "progressive education" at the beginning of the next decade. The classroom was a laboratory, then, in the same sense—and for the same reasons—that Bruno Latour invoked when he wrote "Give me a Laboratory and I Will Raise the World." It had power—new, but real—beyond its walls.[52]

Dewey shared this sense of the laboratory's power with his friend Jane Addams, then doing her own experiments at Hull House in Chicago. While she rejected the name "sociology laboratory" for Hull House "because a Settlement should be something much more human and spontaneous than such a phrase connotes," she called her work "an experimental effort to aid in the solution of the social and industrial problems which are engendered by the modern conditions of life in a great city." Addams's projects, including with the Working People's Social Science Club, were all experimental: "The one thing to be dreaded in the Settlement is that it lose its flexibility, its power of quick adaptation, its readiness to change its methods as its environment may demand. It must be open to conviction and must have a deep and abiding sense of tolerance. It must be hospitable and ready for experiment. It should demand from its residents a scientific patience in the accumulation of facts and the steady holding of their sympathies as one of the best instruments for that accumulation." Like Dewey's school, Hull House was an organic whole. According to Addams, the idea emerged from "the desire to make the entire social organism democratic, to extend democracy beyond its political expression"—which is what Dewey was after as well. Science's

experimental ethos, understood as spontaneous and natural, was the key not just to imagining a just and democratic society, but to making one possible.[53]

Addams and Dewey were joined in their "spontaneous" reform by George Herbert Mead, a former student who came to Chicago with Dewey in the 1890s. Mead, a founder of sociology and social psychology, did more than anyone to push Dewey's evolutionary theory from the individual to the social sphere. Active in local politics and the labor movement, Mead sought to fuse political and academic projects, "to establish the theory of social reform among the inductive sciences." To do this, he thought both science and society needed to be redefined as *hypothetical* pursuits. "In the social world we must recognize the working hypothesis as the form into which all theories must be cast as completely as in the natural sciences," he wrote, adding that "this is the attitude of the scientist in the laboratory, whether his work remains purely scientific or is applied immediately to conduct. His foresight does not go beyond the testing of his hypothesis." Method marked the way forward for a union of science and social reform, so long as the working hypothesis was central. In a way, Mead's methodological commitment closed a loop: a century before, hypotheses had been all but forbidden in the tradition to which he was an heir. By the eve of the twentieth century, he was making hypotheses not only central to science, but the key to social productivity and political activism.[54]

"The settlement is practical in its attitude," Mead wrote, "but inquiring and scientific in its method." Recognizing the scope of hypotheses, their power as well as their limitations, was already a key component of the experimental work being done by Addams, Dewey, and others. But using the scientific method in these social contexts entailed an extra complication: scientific studies of society *change* society, which in turn changes science. What Mead called "reflective consciousness" in the scientific method started a feedback loop through which science intervenes directly in its objects: "Reflective consciousness does not then carry us on to the world that is to be, but puts our own thought and endeavor into the very process of evolution, and evolution within consciousness that has become reflective has the advantage over other evolution in that the

form does not tend to perpetuate himself as he is, but identifies himself with the process of development." The result was "an identification of our effort with the problem that presents itself," culminating in "the recognition and use of scientific method and control." Everything, from everyday life to social movements, led back to science—redefined as an evolved tendency inside all of us, a natural feature of adaptive, embodied cognition.[55]

What Addams discovered at Hull House and Mead found at labor meetings, Dewey learned in the classroom. For all three, science was something spontaneous, and it certainly was not limited to its familiar manifestations in the botanical garden or the chemistry laboratory. It was a quotidian practice, and not just that: it was a requirement for living in the modern world. What Addams would call a "subjective necessity" and Mead might dub the ultimate "working hypothesis" was the culmination of decades of thinking scientifically *about science,* about where everyday behaviors ended and scientific investigation began. Significantly, it was not enough for any of the three to say that these broader phenomena reduced to what went on in the mind. Addams, for example, did not oppose the "subjective necessity" of her famous piece on settlement houses to their "objective necessity" from a political perspective. The two needs were the same, individual and social sides of a single problem confronted in modern society. For Addams, as for her colleagues in Chicago, science was an attitude of mind geared toward fusing the individual and the social, toward solving political problems in a democratic way.[56]

At its root, scientific method *was* cognition. Unfolding at the intersection of evolution and experiment, of natural selection and hypothesis testing, it was indistinguishable from the way problems of survival were "solved" well beyond the laboratory—or beyond the human. "The experimental method is the method of making, of following the history of production," wrote Dewey. "And, as already intimated, the conception of evolution is no more the discovery of a general law of life than it is the generalization of all scientific method." This was both a natural history of science and a manual for living. "Democracy is possible only because of a change in intellectual conditions. It implies tools for getting

at truth in detail, and day by day, as we go along." Evolutionary theory was the change in conditions Dewey had in mind, and psychology was the best tool for getting at it. Where, decades earlier, Darwin had forged an evolutionary theory out of an experimental ideal, Dewey now justified a broad experimental philosophy as the fruit of mental evolution. Together, mind and method were supposed to start a new era in politics and pedagogy. Or at least, that was the idea.[57]

HOW WE THINK

"Scientific method," Dewey told an audience of scientists in 1910, "is not just a method which it has been found profitable to pursue in this or that abstruse subject for purely technical reasons." Their subject was much bigger than that. "It is not a peculiar development of thinking for highly specialized ends; it *is* thinking so far as thought has become conscious of its proper ends and of the equipment indispensable for success in their pursuit." Scientific method was not just the right tool for the job—it was the only tool for any job. A few years earlier, Dewey had made the same point by illustrating the scientific method of "the plain man": "He assumes uninterrupted, free, and fluid passage from ordinary experience to abstract thinking, from thought to fact, from things to theories and back again. Observation passes into development of hypothesis; deductive methods pass to use in description of the particular; inference passes into action with no sense of difficulty save those found in the particular task in question." As Dewey had gleaned from James, our minds are streams, not trains; they overflow their banks and are as real as the rocks you walk on. The scientific method was not just the best way to solve those problems we labeled scientific; according to Dewey, it was *how we think,* full stop.[58]

The same year Dewey told scientists that their method was everyday thinking, he gave a wider audience an accessible introduction to the same topic. Though he was now at Columbia (he had left Chicago partly over an argument about his wife's employment status), Dewey was still drawing on the experiences he had accumulated there. The book in

which he did so, *How We Think,* was an effort to distil the lessons of the Laboratory School into a general account. Dewey laid out his cards in the preface: "This book represents the conviction that the needed centralizing and steadying factor is found in adopting as the end of endeavor that attitude of mind, that habit of thought, which we call scientific . . . [and] that the native and unspoiled attitude of childhood, marked by ardent curiosity, fertile imagination, and love of experimental inquiry, is near, very near, to the attitude of the scientific mind." As the ensuing pages made clear, Dewey owed this insight to the teachers and students with whom he had worked at the Laboratory School. Having drawn on his experience in many articles and books, Dewey was taking a moment to step back from technical matters to reflect on thinking in general. As always, he felt children exhibited it in its purest form.[59]

At the center of *How We Think* was what Dewey called "the analysis of a complete act of thought." Illustrated with quotidian examples—doing the dishes, calculating a journey uptown—the idea was to draw out of individual acts of reflective thought a general pattern, something like what he had done when describing students' efforts in earlier books. In *How We Think,* this took the form of a numbered list, meant to summarize the book's claims in a convenient format:

> Upon examination, each instance reveals, more or less clearly, five logically distinct steps: (*i*) a felt difficulty; (*ii*) its location and definition; (*iii*) suggestion of possible solution; (*iv*) development by reasoning of the bearings of the suggestion; (*v*) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief.

On the surface, there was nothing special about Dewey's list. It looked like the account of "the plain man" he had published in *Studies in Logical Theory,* with its emphasis on hypotheses and the confrontation of everyday problems. But the inclusion of numbers set the "steps" apart from one another, paving the way for chopping the list into bits. Far from a stream, thinking now seemed like a ladder, planted in difficulty and reaching toward resolution.[60]

If the numbers in Dewey's list made acts of thought seem almost algorithmic, his focus on its individual character obscured the social side of learning and science. Studying "the free play of the children's communicative instinct" had led Dewey to recognize that we learn not only by doing, but also by talking—that is, by interacting with one another in a social setting. While that setting was absent from the logical analysis of Dewey's list, the rest of *How We Think* was full of "social stimuli" and "social conditions"—the indispensable foundations of thinking. On Dewey's view, the evolutionary history of our minds was resolutely social, an adaptive response not to problems we encountered individually, but to those we grapple with as a group. Mead took this to the next level, arguing that our very sense of self, our status as individuals, had emerged from our sense of *selves,* of others. In the same year as *How We Think,* Mead put this point in stark terms: "Other selves in a social environment logically antedate the consciousness of self which introspection analyzes." Studying others was a way to study ourselves; knowing how we might behave is only useful as a clue for how others will. Evolutionary theory, which so often seems to emphasize the lonely, harried, surviving individual, in fact revealed the broader context in which any adaptation might have originally helped individuals thrive socially.[61]

Science, seen as an adaptation, was a tool for controlling others—and, only because of that, a tool of self-control. As Mead put it in another essay from the same year: "Successful social conduct brings one into a field within which a consciousness of one's own attitudes helps toward the control of the conduct of others." Though it was far from Mead's (or Dewey's) intention, the language of success and failure, the product of an evolutionary logic, entailed its own surprising results for psychologists—whether they entered the classroom or not. A sense of *why* this or that trait proved advantageous, a focus on utility in the past or the present, seemed to lead to a new push for prescriptive, rather than simply descriptive, accounts of learning and problem solving. An interest in educational issues, especially those related to the role of science in social progress, only buttressed this shift. Methodological debates had been intertwined with ideas about teaching and learning since Herschel's formulation of a reform method, but the rise of child study toward the

end of the century placed a new premium on models of mind, turning descriptions of science and its method into prescriptions for how to think scientifically. This transit from is to ought, from a tacit feature of earlier debates to the avowed goal of new ones, depended upon Dewey and Mead's social vision but also helped eclipse it. In the hands of their enthusiastic followers, the embodied cognition of early evolutionary psychologists became a disembodied manual for thinking scientifically.[62]

The broader shift from social to individual and from descriptive to prescriptive helps explain the reception of Dewey's numbered list. Both the start of the process ("a felt difficulty") and its goal ("the conclusion of belief") were *meant* to fit into a broader world. But it is easy to see them instead as introspective rather than interactive. Dewey saw no barrier between the two, as the rest of the book and his life's work made clear. Yet his five steps implied otherwise. The list's staccato format made it extractable, exportable, a kind of one-size-fits-all tool of the very sort Dewey was trying to fight in the classroom. Absent the evolutionary and experimental concerns in which the list had been forged and that it was meant to signal, the thinking process it represented seemed at once narrower and more general. What had started out as "a complete act of thought," an accessible account of *How We Think,* could now be read as a set of rules for right thinking. A description of what makes us human, of how we connect to the world around us and how we might do so more successfully, could become a prescriptive ritual, a method only. And that was precisely what happened.