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Introduction

PERIPATETIC PRACTICES

THE MIRROR SELF-RECOGNITION TEST is, in its experimental setup at least, extremely simple. A mirror is placed in an open space, often attached to a wall or standing vertically on the floor. The subject, perhaps a small child or an animal, is put in front of it. These circumstances are reproduced daily in countless homes around the world. Nothing could be more common. And yet, if present at the right time, paying attention to the right subject, one might observe something extraordinary. The subject might start by acting surprised at the image. It might approach it cautiously, or perhaps even aggressively, because the image seems to be similarly suspicious and unfriendly. But often, and after a little time, things begin to change. The subject no longer appears on edge. It is relaxed, happy even; perhaps it smiles. Playfulness has replaced suspicion. The subject might move its hands, its eyes shifting back and forth between the physical body and its reflection. It might open its mouth wide, leaning into the mirror so that it can see its teeth in the reflection, perhaps even pick out a piece of food caught between two teeth. Throughout this process, we are confronted only with outward behavior, the way the body moves at different stages of the encounter. But it is easy, unavoidable perhaps, to see these as the outward signs of an internal psychological drama, whereby the subject looks in the mirror and slowly comes to see itself. Might we be witness to the dawning of self-consciousness?

When I told people that I was working on a book about mirrors, I received a wide range of responses. A medievalist colleague cited Saint Paul: “Videmus nunc per speculum et in aenigmate” (1 Cor. 13:12, Vulg.) (We do not now see [God] but through a mirror, darkly). Another confessed to me that he used to stare at the mirror as a young man to see if he really existed (he did not say

what was the result). One shared how intrigued she was with the use of mirrors in the film *The Black Swan*, where the mirror revealed to the protagonist Nina Sayers (played by Natalie Portman) her hidden and dark identities. Yet others evoked the myth of Narcissus losing himself in his reflected image, or Aesop's dog, who foolishly jumped at his reflected image in a river to steal another dog's bone, thus losing the one he had to start with. My own motivation for the book came from a personal experience of observing my twin girls playing with a mirror when they were small. Despite its mundane ubiquity, the mirror remains a strange and endlessly fascinating object, because it seems to tell us new truths about who we are.

A History of Mirrors

The mirror has not always been an everyday item. In the ancient world, when mirrors were made from polished bronze or metal alloys, they were available only to a select few.¹ Their preciousness depended on the kind of metal chosen for their production. Egyptians and Sumerians made copper, bronze, gold, and silver mirrors. The Romans used polished obsidian, a black volcanic rock. What ancient mirrors had in common is that they were all fairly small, around five to eight inches in diameter. They shared this property with the earliest glass mirrors in the Middle Ages, which were constructed by applying a layer of metal to glass. Given the heat needed to melt the metal, and the challenge of blowing glass that was sufficiently flat, medieval glass mirrors were small and distorting, as in Jan van Eyck's famous *Arnolfini Portrait* (fig. 0.1 and plate 1).²

A dramatic increase in size and decrease in cost was secured in the sixteenth century by glassmakers from the island of Murano near Venice. Drawing on centuries of glassmaking expertise (and using the highest-quality ingredients including seawater, and a type of wood that burned to produce a clear flame), they were able to make glass that was pure and clear. Thanks to their refined technique, they were also able to make larger mirrors, measuring up to forty square inches. These brought the Republic of Venice substantial wealth, and its wares were prized across Europe and the Middle East.³ Accordingly, the Venetians guarded their secrets jealously—Murano workers were prohibited from emigrating, or even speaking with strangers.⁴

The French broke the Venetian monopoly in the late sixteenth century. The company Saint-Gobain, heavily subsidized by the state, managed to lure a few artisans from Murano to Paris, where they perfected the method of casting large glass mirrors.⁵ For the next 150 years, French-cast glass mirrors set the



FIGURE 0.1. Jan van Eyck, *The Arnolfini Portrait*, 1434. The mirror also has a revealing function: two people are entering the room, one of whom could be the painter. Source: Wikimedia Commons.

standard, as represented most famously by the mirror hall at Versailles, which was unveiled to the public in 1682.⁶ The French glassmakers used mercury to add a reflective coat to the glass, which took a serious toll on their health. In addition, the mercury left a greenish-gray tint that muddied the reflection. Mirror makers were thus on the lookout for alternatives, the most famous of which came from a procedure developed by the German chemist Justus von Liebig in 1856.⁷ He used an aldehyde reaction (he found that aldehydes reduced silver salts to metallic silver) to add a layering of silver to glass.⁸ Living through the “century of optical instruments and visualization,”⁹ Liebig originally developed his method in order to improve mirrors used in scientific instruments, such as microscopes, telescopes, or Hermann von Helmholtz’s famous ophthalmoscope (*Augenspiegel*). Although at first Liebig’s method could not compete with the existing methods (the factory near the Bavarian city of Fürth to which Liebig sold his license had to close its doors after only two years of production), over the course of the nineteenth century, safety regulations came to restrict the use of mercury, and the Liebig method became

dominant.¹⁰ It also sped up the production process.¹¹ By the end of the nineteenth century, mirrors were everywhere: in shops (the development of special insurance against mirror breakage encouraged department stores to make heavy use of mirrors for interior decoration),¹² in cafés and foyers, and in almost every private home. Today the mirror has become common enough to be almost totally unremarkable.¹³ It pervades the most intimate as much as the most public spaces. It has also, in the guise of the mirror test, pervaded the history of the modern mind sciences.

Psychology and Its Others

The history of the mind sciences has traditionally been told as a sequence of different intellectual movements.¹⁴ The story often starts with Wilhelm Wundt's experimental introspection in Leipzig in the 1870s, which in the following decades made inroads into the United States. Wundt's students were deeply involved in building the infrastructure of American psychology. Stanley Hall founded the *American Journal of Psychology* in 1887 and, with Edward Scripture, the American Psychological Association (APA) in 1892. By the 1910s, however, some began to worry that Wundt's introspection leaned too heavily on subjective and thus unreliable experience. Most importantly, in his "behaviorist manifesto" from 1913, John B. Watson sought to bypass introspection entirely, focusing solely on external behavior. By studying how individual stimuli were tied to particular responses, psychology could work toward a goal of "prediction and control," which he thought would have wide-ranging social applications.¹⁵ In the 1940s, so the story goes, behaviorism too came under assault. Building on the efforts of cyberneticians to promote a broad interdisciplinary conversation, as exemplified by the legendary Macy Conferences in New York (1946–53), developmental psychologists came together with specialists on the new electronic computers, with neuropsychologists, and with linguists in the Hixon Symposium at the California Institute of Technology in 1948 to seek ways to break free from the narrow confines of behaviorist science. By the 1960s their so-called cognitive revolution, which returned attention to the study of consciousness, had transformed the field. The mind could be studied scientifically after all, in its core functions such as memory, or in the study of language. This narrative has been complicated by a range of excellent studies, but its stagist structure and the narrative in its broad outlines persists.¹⁶

This book, by examining a single test, and following it wherever it appears, carves a less familiar path. The mirror test is particularly valuable because it

allows us to think through the disciplinary richness of the mind sciences. For reasons that will become clear, the test often sat on the margins of different academic fields, connecting psychology with neurology, but also with evolutionary biology, psychoanalysis, anthropology, linguistics, and cybernetics. It also moved between pure and applied research, and research and therapy. It did not respect national borders either. As we will see, an analysis of the mirror test requires us to move between Germany, France, Britain, North America, and beyond.

Though it can be followed as a guiding thread crossing national and disciplinary lines, the mirror test did not form an intellectual tradition, in the sense of a clearly articulated network of textual references. Some mirror researchers appealed to a slowly expanding canon—Darwin and Preyer, and then Lacan, Amsterdam, and Gallup—and in the first two chapters of the book I will analyze the type of intellectual inheritance and influence with which most historians will be familiar. The later chapters, however, tend to deal with scientists who were mostly unaware of these predecessors, and worked independently. Often the mirror emerged in their work serendipitously. When mirrors are common household objects, one might easily encounter a mirror response by chance or integrate it into a research project as an ad hoc measure.

What motivated the turn to the mirror in these different instances was rather a common problematic. While most canonical psychology had focused on the male adult, mirror recognition seemed suited to the psychological study of infants and animals, with occasional forays into the realm of robotics. For this question, the dominant figure in the late nineteenth century was not Wundt but his compatriot Wilhelm Preyer. That is why, at times, we travel along what seem to be the backroads of the mind sciences, discovering figures and movements that have been ignored by much of the scholarship. In particular, this backroad travel draws our attention to numerous women—Milicent Shinn, Charlotte Bühler, Beulah Amsterdam, and Hilde Bruch—who fought against marginalization in their time and are often passed over today. When the mirror test did take paths that parallel and even flow into the mainstream, it encourages us to reconsider traditional narratives in ways that build on the previous scholarship. This strand of psychological research raised questions about the interpretation of behavior and the dangers of introspection, long before any putative beginnings of behaviorism. And yet, focused as it was on the emergence of higher functions, this research retained an interest in communication and the formation of concepts throughout in ways that would allow, in the 1960s, engagement with the “cognitive revolution.”

The study of the nonlinguistic mind came to the fore in the final third of the nineteenth century, because it seemed a promising way to address a problem that had recently emerged but which had far-reaching consequences. For the past hundred years, the category of the human had been invested with enormous political significance. Political power was no longer supposed to derive from one's place in a larger social whole, a whole that was just one part of a divinely ordained "chain of being." Rather it was as "humans" (or, more often, "men") that citizens came together and demanded a role in their own governance. First, qua "men," people did not enter the social realm as members of a particular estate, or guild, or even class, but as individuals. Second, these individuals were granted authority through their reason. Considered the quintessential human faculty, reason was often used to justify the value of liberty and belief in progress and was declared as foundational in new declarations of rights and constitutions across the Atlantic world. For many, reason and individuality found their ultimate foundation in human language, which was considered to be qualitatively different from the forms of communication found among other animals.

Darwin's theory of evolution shook the foundations of this politics. This is not because he deconstructed the boundaries of the human. However much cartoonists lampooned Darwin the man-ape, there was no danger that the evolutionary theorist would come to confuse humans with other creatures. The shock of Darwin's work was rather that in placing humanity back into the bosom of nature, he seemed to undermine our exclusive hold on those properties that were essential to the new politics. How did the rules of natural selection fit with our dignity as individuals? Given the "descent of man," could it be plausibly suggested that human reason was qualitatively different from the mental powers of other animals? Crucially, Darwin denied that human language was *sui generis*.

In this context the mirror test became particularly attractive. It bypassed the question of language, because it could be used on nonhuman animals and children before they could speak, and it allowed scholars to reassert human superiority without falling back on religious notions or metaphysical claims about the soul. Not only did most think, for almost a hundred years, that humans were the only creatures able to recognize themselves in the mirror; they also held that mirror recognition demonstrated precisely the characteristics that were meant to set humans apart. First, in the mirror you identify yourself as an individual. It was assumed that other animals failed the test because they merely saw another animal. Second, it seemed to be the result of

higher thinking. After all the mirror test required recognition, the application of a concept to an image. The mirror test, that is, did not simply serve as a shibboleth separating out humans from other creatures. It did so in a way that flattered humans and endorsed the image they had created for themselves. It offered a means to suture the gaping hole in human pride that had been opened up by the Darwinian revolution.

In the century spanning 1870 to 1970, mirror self-recognition became central to the definition of human specificity. Though other demarcators, most notably language, returned periodically, mirror self-recognition seemed to be the most reliable.¹⁷ Not least it offered that peculiar advantage that it could be tested.¹⁸ The mirror seemed to be able to produce experimental evidence of human distinctiveness, and scientists used it to show that humans and only humans were able to recognize their reflection.¹⁹ Nevertheless, as a test, mirror self-recognition gained its authority by holding open the possibility of alternative answers, and researchers had to take seriously the prospect that animals might recognize themselves. There was always a chance that the test could dramatically change its meaning. Indeed, since 1970, as a Noah's ark of nonhuman animals have been shown to pass the test, it has become a favored tool of researchers arguing for animal rights. That perhaps points to one of the reasons why scientists have returned insistently to the mirror self-recognition test over the past 150 years: never simply a means to confirm existing theories, as an experimental system, it never lost the ability to surprise.²⁰

The Mirror and Material Culture

Whatever hopes individuals might have invested in the mirror test in theory, in the heat of experimentation they were confronted with a set of difficulties resulting from the exigencies of material culture.²¹ Historians of science have been interested in experimental systems and the materiality of scientific instruments for some time. Much in this work has focused on the physical sciences. Take, for instance, Peter Galison's *Image and Logic*, a book about the "machines of physics," such as the bubble chamber and the Geiger counter.²² These machines allowed physicists to study the "microworld": the smallest forms of matter such as electrons, photons, protons, and quarks because the physical properties of those particles interacted with the machines to produce representations of their activity: for instance bubble chambers were constructed in such a way that subatomic particles would produce paths of small bubbles in superheated liquid hydrogen. Galison's machines could mediate between

scientific objects and the knowledge about these objects because they could interact materially with those objects.²³

Hans-Jörg Rheinberger's approach differs from Galison's. He posits a greater instability both at the level of machines (elements of his "experimental systems") and of the scientific objects (his "epistemic things"). By virtue of their capacity for "differential reproduction," experimental systems were capable of creating unforeseeable scientific events; they were "machine[s] for making the future."²⁴ But, as in Galison's account, the machines could help produce epistemic things because they shared physical properties. Rheinberger's main example is the *in vitro* synthesis of proteins. Of course these were "things embodying concepts";²⁵ the transfer RNA that emerged from "soluble RNA" within Rheinberger's experimental system embodied Francis Crick's "adaptor hypothesis," which introduced the language of information transfer. But as Rheinberger himself makes clear, his "epistemic things" were "material entities or processes—physical structures, chemical reactions, biological functions."²⁶ In these two canonical accounts of material culture, then, we see a commonality between the apparatuses used by scientists and the objects studied; *material* culture is useful for studying *material* things.²⁷

In more recent years, the study of material culture has carved a path into the mind sciences by examining media, from Alessandro Mosso's brain plethysmography, through the EEG, to fMRI scans, but also photographs, film, and writing systems.²⁸ As Cornelius Borck has pointed out, in contrast to physiological inscriptions produced by the activity of other organs, like the electrocardiogram, the scribbles produced by activity of the brain in the EEG were considered to be not simply a *trace* produced by the human body, but forms of *writing*, produced by and thus revealing the subject.²⁹ Historians of science have shown how these "psychographies" were, in the tradition of Jules de Marey's *méthode graphique*, attractive as forms of nature writing itself—providing immediate and transparent access into the workings of the mind.³⁰

The mirror too is a medium (though as we will see, what type of medium was a vexing question). Yet the mirror function is different from the function of other media. In most cases, the medium is the means by which the scientist comes to know the subject. It stands between the researcher and what is researched, controlling the flow of information between the two. But the mirror doesn't itself offer researchers anything new or different. In the self-recognition test, the scientist rarely, if ever, looks at the reflection. Rather it is the *subject* who is gazing into the mirror, and the scientist is concerned with how that subject responds.

At the most basic level, the mirror is an apparatus that alters the path of light rays in a consistent way, so as to produce the illusion that the reflected object exists in another position in space. Though the image is inverted, this is usually apparent only when the mirror reflects the written word, and in most cases what we see is not dissimilar from what we are able to perceive without a mirror.³¹ That is why it is so easy to mistake a mirror image for the real thing. A mirror is perhaps useful for observing an object from an otherwise inaccessible angle, but normally there is nothing surprising or novel about the image it offers.

Something different occurs, however, when we turn our attention to the reflection of our own bodies. For then, we see more than another body in space. We see an object that is both familiar and unfamiliar, what is closest to us viewed from a perspective that we are normally denied. In the mirror we see ourselves as if through the eyes of another. In transforming our bodies from something that we are and feel into something that we encounter as a distinct and separate object, the mirror prompts a range of otherwise unusual cognitive acts. It encourages us to project our proprioceptive selves into the external world. Consequently, the mirror image could become a vehicle for a range of subjective impressions—in the mirror we see our desires and our fears—and even higher-order concepts, such as the self or ego. And this was especially important for those subjects, such as infants and animals, who had often been excluded from studies of higher function, because they lacked the linguistic capacity required for the tests. Here, rather than being a more or less transparent point of access through which the scientist is able to study the mind, the mind is revealed through the very distortions produced when the subject sees its own mirror reflection.

And yet, these distortions are not immediately available to the researchers. Because the mirror test most often involved non- or prelinguistic subjects, one could not ask them to describe their experience. Instead, scientists were reliant on an examination and interpretation of the subjects' behaviors. The focus on behavior helps drive one of the central questions of the mirror self-recognition test. How do we actually know what the subject sees in the mirror? On the one hand, interpretation seems easy. When we as adult humans look in the mirror, we see a reflection of our own bodies, and so it is only natural to look for the same recognition in other creatures. An aggressive response might suggest that the subject takes the image to be someone else. A smile, perhaps, is an indication that something has clicked, that the subject has recognized itself. But on the other hand, however intuitive these interpretations were, they proved extremely difficult to justify.

That is why the mirror self-recognition test cannot be considered in its simplicity. As we will see, scientists tended to build around it a range of practices and techniques to control and order the ambiguity of the behavior. They developed notation strategies; compiled strict testing protocols, often laid out in questionnaires; and, when it became available, were early adopters of video recording. The study of the mirror test thus fits into another strand of literature on material culture concerning inscription practices.³² Ever since Ursula Klein described Berzelian formulas as “paper tools” by which chemists could grapple with and thus come to know chemical reactions, historians have extended attention away from the site of experiment to understand the production of knowledge.³³ More recently, scholars such as Anke te Heesen, Andrew Mendelsohn, and Volker Hess have shown that “paper technologies”—notebooks and medical case histories—were used to organize different kinds of information, in ways that opened up science to the everyday.³⁴ In this way, scholars have expanded the reach of what counts as scientific material culture: from scientific models to “things that talk,” which includes objects as diverse as glass flowers, Rorschach tests, and soap bubbles.³⁵

Mirror researchers sought to control the ambiguity of the mirror encounter in another way: by folding it into a range of neighboring but distinct scientific theories, most importantly neurology and its neuroscientific heirs, but also anthropology and linguistics. These disciplines provided an authoritative scientific basis for interpretations of mirror behavior. For example, based on the knowledge that child brain development involved the building of associations between various sensory and motor centers, mirror researchers were inclined to see the effects of those associations in mirror behavior, perhaps even to mark the moment when particular connections were made.

Plan of the Book

This book will approach the history of mirror experiments by foregrounding two, broadly speaking consecutive, problematics. In part 1 (“Identifications”), I examine the history of the mirror test from the late eighteenth century until around 1970, though focusing mostly on the final hundred years. For researchers at this time, the central problem of the mirror test was determining whether the experimental subjects actually recognized themselves in their reflection. The problem arose because the mirror recognition had emerged as a stand-in for the previously dominant demarcator between human and nonhuman animals: language. In chapter 1, we see how a tradition of baby diaries emerged in

the attempt to find a secure evidentiary basis for debates about the origin of language and thus human specificity. But in his baby diary, first composed around 1840 but published over thirty years later, Darwin argued that human language was closer to animal communication than had previously been supposed. Researchers were left scrambling for alternative demarcators, and they found one in the mirror, which had previously had a recurrent if marginal role in the baby-diary tradition.

In putting aside language, however, and thus focusing on nonlinguistic creatures, infants and nonhuman animals, psychologists like Wilhelm Preyer denied themselves one of the most powerful tools for understanding the behavior of their subjects. Without being able to ask them what they were experiencing, mirror researchers sought new ways of determining what their subject's reaction to the mirror meant. As we will see in chapter 2, the tension between the broader goals of the mirror recognition test and the difficulties of interpreting the results drove significant innovation in the practices involved. At first, in the 1880s and 1890s, this opened space for a range of women to engage in academic psychological research. But it also provided a neglected yet driving problematic for some of the canonical figures in the field throughout the first decades of the twentieth century.

The central tension of the mirror test was articulated most pointedly by the cybernetician Grey Walter (chapter 3). In the 1950s, he constructed a range of robotic "tortoises," which behaved in front of the mirror, he suggested, as if they recognized themselves. But whereas the other mirror researchers were unable to peer into the black boxes that were their subjects' minds, Walter could. This extra insight led him to mock those who thought, prematurely, that they had witnessed self-recognition. This tension continued to be the guiding problematic of the mirror tradition, until the introduction of the mark test, which was developed simultaneously by Beulah Amsterdam and Gordon Gallup around 1968 (chapter 4). Though it remained contested, the mark test provided a relatively secure means of determining self-recognition, by seeing what happened when the subject saw in the mirror a mark on their body that was not otherwise visible.

In solving the problem of how one could determine *whether* the subject could recognize its reflection, the mark test opened up space for another question: What does this recognition *mean*? This shift in questioning is exemplified by the career of French psychologist René Zazzo, who I discuss in the interlude. Upon integrating the mark test into his work, Zazzo started to tease apart the different stages of recognition, paying particular attention to the fact that

the mirror image was an optical illusion. In part 2, “Misidentifications” I show how the illusory aspect of the image figured into a broad rethinking of the test. As we will see in chapter 5, already in the 1930s, Lacan had foreshadowed this shift in his famous “mirror stage,” where a baby misrecognized its reflection, taking the unity of the mirror image as a sign that it too was psychologically one. He argued that the mirror image can be strange and alienating, shaping our views of ourselves as much as it reflects them.

In the 1970s and beyond, a similar insight motivated mirror researchers in a range of fields, who though they remained unaware of each other developed a strikingly similar set of claims. In chapter 6, I examine the work of Edmund Carpenter, who thought he had discovered a “mirror-naive” society among the Biami of Papua New Guinea. The experience led him to meditate on the deleterious effects of mirrors, disrupting previously held beliefs about the nature of media that he had drawn from Marshall McLuhan. For anorexia researchers in the 1980s and 1990s (chapter 7), the mirror represented both a point of access to the distorted sense of the body that they thought caused the disease, and a means to change it. Finally, in chapter 8 I examine a parallel development in the neurosciences, with the discovery of so-called mirror neurons. These mirrors were not physical objects; they had been internalized as crucial components of the brain. But in allowing an identification across difference, between self and other, mirror neurons resurrected and reformed many of the key questions of the mirror tradition, including, sociability, language, and human-animal difference.

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