been echoed by other prominent ecologists who lament the loss of natural history–based classes at all levels of education (Dayton and Sala 2001). His focus on observation is not surprising, as he works in a field where few experiments are possible and large observational data sets gathered from the fossil record must be brought to bear. Yet this focus on observation has certainly not handicapped Vermeij as a scientist. He has not only contributed substantially to ecology and the study of evolution, but also to a wide range of social studies—from economics to security—in the course of his career (Vermeij 2004).

What is surprising is that he has been blind from a young age, dependent upon his tactile sense to “observe” the natural world, as he describes in Box 3.1. Many sighted scientists have marveled at how Vermeij’s tactile

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**BOX 3.1**

**The Importance of Sensation**

**GEERAT J. VERMEIJ**

Scientists revel in a way of knowing that uncovers an approximation of verifiable truth through observation, evaluation, and inference. We have refined this method, but scientists did not invent it. From the beginning, living things have sensed, interpreted, and responded to circumstances that could make the difference between life and death, success and failure. Informed by their senses, organisms embody a hypothesis of their environment; and when this hypothesis is tested—when an organism’s structure, physiology, and behavior work adequately—it can be improved as the body and the environment as sensed and interpreted by the organism feed back on each other, both through immediate effects and over evolutionary time through natural selection. A profound parallel exists between adaptive evolution and the more purposeful scientific way of knowing. Environment and hypothesis converse, whether in the body of an adapted organism or in the mind of a human being.

This parallel highlights the essential, and increasingly ignored, role of sensation—of observation with the brain in gear—in learning about the world. There is nothing like being puzzled by a chance observation to awaken curiosity, nothing like carefully listening and looking and feeling and smelling to conceive ideas,
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Ask questions, and formulate theories of how the world of things and people works.

As a blind boy, I daydreamed about the tropics. There were fine descriptive books about the lush vegetation, colorful birds, and beaches strewn with wonderful shells; and I have an inkling that some of the world’s great natural scientists—von Humboldt, Darwin, and Wallace among them—were so stimulated by the things they saw in those equatorial regions that they changed our very conception of the world of living things. But it took first-hand experience—literally, of course, and first-touch and first-nose experience, too—to make me ask questions and ultimately perhaps to understand the wet, warm forests and the thrillingly diverse reefs and sandflats of the tropics. It was these experiences, informed by the senses, that helped shape my scientific worldview.

Children today are taught to take tests. They study virtual representations, and are in the position of passive consumers of films and real-time feeds as others explore the world through their own sensibilities. The unfamiliar, insofar as it is accessible at all, comes packaged and manufactured. Is it any wonder that our curiosity withers and our contact with the world atrophies?

Good observation is a skill, to be honed and nourished and improved. It is like reading or writing: the more you do, the better you get at it, and the more the world opens up to you. Educators, pay attention.

Observations channel intricate details and life histories from fossilized shells that they themselves could not see with their own eyes. His story is jolting to the sighted among us because most of us immediately think of our visual sense when we think of “observation.”

Vermeij’s story begins to reveal the astonishing adaptable capacity of our observational abilities, and this capacity comes into still greater clarity when we consider another highly accomplished teacher who also happens to be blind. Daniel Kish observes the world primarily through sound. He taught himself at a young age to use his own sonar system, by making audible clicks and listening for their echoes (Kish 2009). Soon he could identify the shape and materials of objects in his surroundings. He could get himself to school and through his day on his own. He could