Acquisition and analysis of information followed by a process of objective evaluation leads to critical thinking and logical inferences. This has certainly been one of the goals of education since the Renaissance. But how does one achieve or even approach these goals? This book by Yurika Sammori is a seminal contribution to the field of education because it addresses this issue in a practical manner and the author should be congratulated for her achievement. The author's program applies not just to educational systems where rote memorization is emphasized and individual analytic skills are not encouraged, but to systems everywhere. Traditionally, children have been taught numbers, alphabets, multiplication tables, poetry, and religious texts by rote memorization. Rote enables us to learn those skills that allow us to perform our daily activities: arithmetic, recognition of alphabets and numerals, and religious practices. We teach these skills to our children to prepare them for life. Despite this pattern of education over the centuries, there have always been adults who have discovered new ways to do things, primarily through careful observation and deduction, and they have transmitted these innovations to the younger generation in school or in apprenticeships as patterns which were then learned by rote memorization. Had these innovations not occurred, there would have been no progress in any field. So what was different about these people, how did they become innovative, and what can we learn from them?

With the exception of physicists and mathematicians who accomplish their major breakthroughs by their early twenties, most other professionals tend to be innovative in their late twenties and beyond. The common thread seems to be learning primarily by rote memorization in elementary school and college followed by the serious introduction to the development of analytic skills in graduate school. After graduation, real life experiences transform all this knowledge into innovative thinking that results in progress and transmission of new information to the younger generation. A typical example is the medical student who memorizes huge amounts of information that include facts, patterns of laboratory tests, patterns of patient behavior and appearance, and patterns of medical history and disease symptoms. They apply this knowledge to the care of the sick during residency training and the early years of clinical practice. After several years of clinical practice, the new experiences that have been encountered are integrated with the rote-learned patterns of previous years and most physicians then acquire the art of deducing new patterns that they were never taught. These are the doctors we admire and strive to be because they are the ones who solve complex problems that other doctors cannot. The same concepts apply to every field of endeavor. This pattern of education raises the question of whether there is a way to accelerate or enhance the development of this analytic skill in an individual, as well as how early in life one can initiate this process.

Visual training is the key. Detecting details and patterns in images, data streams and text is the first step toward realizing the goal of critical thinking and

analysis. If one cannot see the details, then there is nothing to analyze. A few examples of how visual training has improved the observational skills of individuals can be offered. At Yale Medical School, first year medical students, still naive in clinical medicine, were able to significantly improve their written descriptions of pictures of patients with diseases after they had examined paintings when compared with a control group of first year students who did not experience this visual training[1]. Each student, in a group of four to five, described the details in their assigned painting to the others in the group, and they were not allowed to make any interpretations unless they could be supported by objective findings in the painting —a system identical to that used by Mrs. Sammori. While the medical school curriculum stresses rote memorization of patterns, the museum workshop stresses the recognition of details in the unfamiliar. As Mrs. Sammori emphasizes in her book, the written descriptions of the pictures by the children in her Institute are very important in enabling the child to organize the visual information and convey it to others in a meaningful way. That is the prime purpose of medical records used in hospitals and physicians' offices. The oral descriptions by medical students of the above mentioned pictures of patients with diseases were far inferior to the written descriptions of the same pictures by their classmates. Adrian-Harris showed that radiologists who studied columns of consonants in which there was a letter to be identified were able to make more accurate diagnoses in radiographs than a comparable group of radiologists who did not undergo this visual training[2]. Finally, Professor Christiane Nusslein-Volhard was awarded the Nobel Prize in Medicine in 1995 because she observed a subtle change in the developing fruit fly egg[3]. Although many investigators had worked with the same material, she was the only one who detected this subtlety. She had a hobby of making jigsaw puzzles based on modern paintings such as those of Mondrian. She cut out her own pieces with no two being alike. The pieces were cut along boundaries that did not cross fields of color or of shapes that would assist her in assembling the puzzle. She had to rely solely on the outlines of the pieces and how they fitted together.

The logical extension of these few studies is to start with children, as Mrs. Sammori has so successfully done. Analysis of pictures is an experiential event that provides children, as well as adults, with an insight into the process involved in the recognition of details and patterns and the construction of hypotheses. Lecturing about observational skills does not provide insight; a personal experience of analysis is necessary. Learning how to find details and recognize patterns lends itself to acquiring information from reading texts and analyzing them, so that critical thinking can be developed. These skills can become lifelong and instinctive if begun early enough and reinforced through practice. In the United States, there is no such organized educational program that I am aware of, but elementary school children often visit museums for art appreciation where docents will engage the children by asking "what do see in this painting?" There are many books with visual puzzles such as the "Where's Waldo?" series available to children. Although these books are meant primarily for entertainment, academic skills can be derived from them.

I heartily endorse Mrs. Sammori's program. Not only would critical and analytical thinking unite peoples from different cultures in the conduct of commerce and intellectual interchange, it would inevitably assist in conflict resolutions as well.

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Footnotes

1. Dolev JC, Friedlaender L, Braverman IM: Use of fine art to enhance visual observational skills. JAMA 286:1020-1021, 2001

2. Adrian-Harris D: Aspects of visual perception in radiography. Radiography XLV:237-243, 1979

3. Wieschaus E, Nusslein-Volhard C, Kluding H: Kruppel, a gene whose activity is required early in the zygotic genome for normal embryonic segmentation. Developmental Biology 104:172-186, 1984