Chapter 5
Duality of Natural and Technological Explanations

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ABSTRACT

This chapter provides visual interpretations of natural and human-made events as examples of cognitive solutions for knowledge visualization. Mathematical description of technological and art related solutions pertaining to the earthly and celestial events is followed by examination of physical concepts versus sports. After that, the chapter explores cell biology versus human habitats; description of natural and human-made new materials at macroscopic, molecular, and atomic scales; an account of carbon as a gem, a molecule, and a heart of nanotechnology; and finally, a text about geography and maps, along with objects and events they represent. The leading format of this chapter is integration of multiple disciplines toward developing an interdisciplinary way of delivering knowledge through visualization-related electronic visuals, needed in every discipline. Issues and materials comprised in this chapter indicate the importance of the visual part of knowledge presentation for cognitive learning.

INTRODUCTION: DUALITY OF NATURAL AND TECHNOLOGICAL APPROACHES IN KNOWLEDGE VISUALIZATION

The title of this chapter indicates the duality of our perceptions and attempts to cope with the nature- versus technology-related problems. In accordance with a description of cognitive learning in Chapter 2, the goal of this chapter is to emphasize the role of the visual approach to natural and scientific processes. Duality in the way we approach the theoretical and practical solutions may become a means to explain these processes as a source of inspiration for creating art and knowledge visualization projects.

Science-based problems can be solved as computer graphics, computer art, algorithms, animations, interactive art, VR, or web art. They become examples of cognitive solutions for knowledge visualization. Knowledge visualization has become an integral part of everyday life because of the presence of applications, which present knowledge in a visual way along with numerical and verbal materials. The ubiquitous, pervasive, and wearable apps, bots, medical equipment,

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wireless and wired communication means are physically present or can be found online, through the phones, and in many other ways. Knowledge visualization can be also done through composing music, producing video, architecture, or 3D installations. Artists examine problems and their solutions to transform them into visualization compositions, which are beautiful for the eye and the mind because they contain unity, symmetry, patterns, golden section instances, and thus imply serenity and beauty.

We often utilize current technological appliances and applications without thinking about scientific disciplines that have been necessary to create them; on the other hand, our knowledge of science disciplines paves the way for creating nature inspired solutions to high-priority problems and their practical applications. Some laws of physics can be explained and visualized as events, for example sport events. On the other hand, topics about human anatomy, nerve and muscle physiology that are involved in supreme sport achievements can be examined in terms of physics. One may see duality in our approaches to everything we tackle.

When cogitating on one's everyday contact with objects such as a rock in a garden and a mouse on a desk one can find some duality of the ways these objects are encountered and acquainted. Figure 1 shows a work "Duality" created by my student Cameron Grimes. His take is more psychological. It is about our own perception of us. Evidently, it wouldn't be possible to demonstrate visualization advantages in all disciplines. Selection of the areas discussed in this chapter has followed history of my research enterprises and related teaching assignments for my students taking computer art graphics and computer graphics courses.

While observing nature, both mathematicians and artists examine and analyze phenomena to extract the essential beauty in mathematics and art. Mathematicians decipher the rules and underlying principles, analyze relations and dependencies, solve problems related to recording or notation, and visualize the world's structure. Artists familiarize themselves with these solutions by reading up on patterns and repetitions to transform and apply the unity or symmetry in their serene compositions (for example, by examining a Fibonacci sequence, prime numbers and magic squares, a golden sec-

Figure 1. Cameron Grimes, Duality (© 2013, C. Grimes. Used with permission)