

Chapter 9

Mirroring Nature: Symmetrical and Crystalline Structures Derived from Natural Forms

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ABSTRACT

This chapter provides discussion of the visual ways of learning basic physical and chemical concepts related to symmetry and the crystalline structures. All kinds of symmetrical structures are present in substances and their various molecular compositions that are researched in fields related to pharmacology. Great part of technologies, methodologies, tools, and applications require knowledge visualization skills to understand and present concepts and processes. Exploration of science-based concepts and nature-related processes supports attaining visualization literacy, which is needed for explaining physical and chemical notions, clinical procedures, and publicizing clinical and mobile medical informatics. This chapter discusses the ways of preparing to this task artists, graphic designers, computer graphics students, as well as people in charge of hospitals, medical centers, and pharmaceutical industries who hire designers. The chapter offers exercises in visualization of scientific concepts by providing two projects about basic science-related themes: (1) Symmetry and pattern in animal world: geometry and art, and (2) Crystals and crystal caves. Each project invites the reader to create visual presentation of the theme.

INTRODUCTION

We cannot overstate the role of knowledge visualization (Bertschi, Bresciani, Crawford, Goebel, Kienreich, Lindner, Sabol, & Moere, 2011) in building trust and cooperation between patients and physicians. Knowledge visualization uses visual representation to transfer knowledge between individuals. It happens often that people who are in charge of hospitals, medical centers, and pharmaceutical industries hire artists to produce visual and time based presentations of particular disease developments and related symptoms and appropriate medical procedures in order to inform patients, prepare them for treatment, and gain their informed cooperation in fighting illness. Researchers and teachers seek ways to visualize often hard-to-capture abstract concepts for better understanding and communication. The designing of

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assistive technologies, adaptive devices, and rehabilitative appliances, aimed at supporting good condition and improving capabilities of ailing or disabled people, requires of the designers preparation in several domains. Rehabilitation may comprise both physical and cognitive training involving, for example the use of virtual reality (Khetrapal, 2011). Virtual humans offer potential for interactive training; they may also serve for developing diagnostic skills of developing clinicians (Kenny, Parsons, Gratch, Leusli, & Rizzo, 2007). Apart from direct physical actions, the use of “mobile medical informatics, combined with new techniques for discovering patterns in complex clinical situations” (Gasmelseid, 2011) serves as a means for improving clinical practice. Many times physicians and therapists perform some tasks on behalf of patients with the use of software agents or programs, using multiple information and communication platforms (Gasmelseid, 2008). A great part of technologies, methodologies, tools and applications require visualization skills from the part of designers and users. For this reason, visualization literacy gains in importance, both in the area of explaining clinical procedures and publicizing mobile medical informatics.

Artists, graphic designers, and computer graphics students may play an important role in making the ground for informed collaboration with specialists in the medicine and pharmacy domains. This chapter discusses the ways of helping them to prepare to this aim, taking into detailed consideration notions related to symmetry and crystalline structures. Medical illustration is an applied art discipline comprised of professional medical illustrators. Association of Medical Illustrators (2014) is an international organization promoting the power of visual media to advance science and healthcare. The majority of medical illustrators in the profession have a master’s degree from an accredited two-year graduate program

Current means of delivering knowledge, for example, technologies involving 3D printing (Mercuri & Meredith, 2014), augmented reality (Bredl, Groß, Hünninger, & Fleischer, 2012), and open source printers may support research in pharmaceutical institutions. 3D printing technologies have already arrived to the school environment (Irwin, Opplinger, Pearce, & Anzalone, 2015); Schelly, Anzalone, Wijnen & Pearce, 2015). In 3D printing, based on the rapid prototyping process, additive processes are used, with successive layers of thermoplastic material laid down according to a computer program (Grujović, Radović, Kanjevac, Borota, Grujović, & Divac, 2011; Ravikumar, Khan, Mohanty, Sageer, & Aigali, 2015).

Basic knowledge about therapeutic procedures and understanding the mechanisms of drug action may support such cooperation and prevent making wrong decisions. For example, children not fully aware about the nature of their sickness and the plan for a treatment might hide pills and then throw them away instead of taking a full series of an antibiotic. Adults often enter a vicious circle when they are suffering because of the drugs’ side effects imposed on other organs and so they take painkillers or psychotropic drugs. As a rule, medications have their descriptions attached, printed on their containers and as leaflets. They have the drugs’ chemical names included, along with chemical formulas expressed both as the single lines of chemical element symbols and as the structural formulas – graphical representation of spatial relationship between atoms. While this information is understandable to professionals, in many cases it does not help the patients.

Artists and designers are often hired to develop posters, develop or record short movies, and build physical models, which would be later presented to patients. This work may present much difficulty, as several distinct abilities and skills may be needed to carry out the task as required. For this reason art and design students may need some training in scientific visualization and scientific illustration to become prepared for fulfilling the demands of the society and cooperate with medical and pharmaceutical professionals. Scientific visualization deals with physically-based data that are defined, selected, transformed, and represented according to space coordinates, such as geographic data or computer tomography data of

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