Preface

A SUMMARY

The focal premise of this book is a conviction that multisensory perception is becoming an important factor in shaping the current lifestyle, technology, and reasoning. This is because a growing number of biologically inspired technological solutions are based on our knowledge about living organisms that communicate in ways not resembling the traits of human senses. This is also because social communication is becoming multisensory, interactive, interdisciplinary, and technology-augmented. Researchers are often solving problems according to social behaviors and the heuristic ways the social societies of insects, fish, or birds solve their difficult situations.

With projects involving readers’ cooperation, this book discusses background material that might be useful for computational solutions for knowledge, art, and entertainment. The book offers a discussion of issues related to visualization of scientific concepts, picturing processes and products, as well as the role of computing in advancing visual literacy skills.

The topics introduced above are spread between the two books titled: Perceptions of Knowledge Visualization: Explaining Concepts through Meaningful Images and Computational Solutions for Knowledge, Art, and Entertainment: Information Exchange beyond Text.

NEEDS AND ISSUES THAT AMOUNTED TO SHAPE THIS BOOK

Multisensory Perception of Science and Physical Manifestations

This book emphasizes a need for increasing interest in multisensory, especially visual, ways of thinking and presenting knowledge. Computer scientists, cognitive scientists, science, and technology-oriented professionals are often communicating this need. The world is enthralled by the multisensory solutions because interactive application software such as apps, installations, and multimedia presentations are pervasive in technology, education, and everyday life. Computer scientists, engineers, and technology experts see and acknowledge the power existing beyond visual explanations with comparative power. However, many are not ready to approach this subject in practical terms. Other people take an attitude that an active approach toward visual thinking and presentation of scientific and computational concepts may be marginally interesting to computer scientists or cognitive scientists. The goal of the book is to connect theory with practice, processes with products, and to give the reader an active, engaging experience, which would enhance perception of the role of computer graphics.
Suggestions on How to Read This Book

The chapters of this book include mini-topics that encourage the reader to explain concepts in a visual and verbal way. They serve as a link between theory and the reader’s own practice, and encourage the reader to explain and reveal a visual aspect of a theme under discussion. Reader’s visual solutions will link and connect the conceptual with the depicted and include the reader in an active, visual style of processing and outputting information. In contrast to a textbook-like style, this book offers information about basic concepts and facts as inspiration for creating visual solutions coming from examples of applications of knowledge, as well as trends resulting from developments in technologies.

Many figures in this book have QR codes (Quick Response codes) for the URL of the Website containing color pictures. Many figures containing art works comprise the QR codes in order to bridge the offline text with online presentation of art by enabling the reader to access the Webpage and look at art works. “Digital and Traditional Illustration” provides information and a picture about a structure of QR code matrices designed to be detected as a 2-dimensional digital image by a semiconductor image sensor and then digitally analyzed by a programmed processor. A QR code is a matrix barcode consisting of black modules (square dots) arranged in a square pattern on a white background that records information about an item.

Interdisciplinary Way of Presenting Topics

This book provides a selection of concepts, data, and information belonging to a number of disciplines. This is because most of recent advances in knowledge result from cooperation of specialists in seemingly unrelated domains. Moreover, the progress often moves forward through networking, chatting, using Skype, or simply updating the school-based knowledge. Fields of research become interdisciplinary, interactive, and often integrated. Many themes discussed in this book have been annotated with explanatory notes, some of them being obvious for readers focused on the issues under discussion, and many appearing to be unrelated for those concentrated on other fields of interest.

A question arises about the ways the teaching about art and design could be combined with programming and computing. Both are aimed at enhancing higher-level thinking skills, abstract thinking, creativity, and novelty. Many artists apply programming to create art works or visualizations, and many computing scientists and programmers do the same. The content of these programs becomes a question belonging to the art domain, while inquiries about what can be done to make these programs aesthetic becomes the problem of the usability territory. After pursuing a study of the arts, a programmer may gain a viewpoint about the purpose for programming the individual projects and making sense of it in further phases, and thus achieve a more ontological attitude relative to the essence of being.

While constantly immersed in the mind puzzling natural phenomena, objects, and processes explored by sciences, we gain knowledge and experience, a good deal of it ensuing from our school education. However, educational assessment involves multiple-choice tests as a typical form of testing. In order to prepare ourselves to tests, we have often memorized particular facts, laws, and formulas, each and every one with the test questions in mind. This kind of knowledge interweaves with a whole landscape of knowledge we acquire later. Our knowledge constantly changes along with the developments in technology. At the same time, the school tests are the same for all students, disregarding the diversity of the intelligence types described by Howard Gardner (1993/2011, 1993/2006): visual/spatial intelligence,
verbal/linguistic, logical/mathematical, bodily/kinesthetic, musical/rhythmic, interpersonal, intrapersonal, naturalistic, and existential intelligence. We may feel our own visual or verbal preferences in dealing with our tasks. The projects presented in this book are designed to inspect selected themes from a totally different perspective.

**A Place for the Arts in the Multimedia-Oriented Social Environment**

One may say art is an interpretation of human perception saved accordingly. This book focuses on a visual approach to natural events rather than on their detailed analyses. It encourages the readers to perform some mental activities in a visual way. Many agree that our ways of communication are drifting toward visual media; our efficiency in sharing knowledge and emotions may depend on our adaptability and ability to convey them in an up-to-date way. It may have something in common with Barbara Smaller’s wish that was pictured in a June 4, 2012 issue of *The New Yorker* (p. 114): “I’m looking for a career that won’t be obsolete before my student loan is paid off.” This book attempts to respond to the changing role of art and promotes including the learning of art into the technology-oriented world.

Viewers used to appreciate art they considered beautiful, which often was meant as the lifelike art works that resembled real-life objects. At the present time, due to the pervasive presence of social networking sites, groups of interconnected people exchange information and cooperate applying computing. Their creative activities involve higher-level thinking processes aimed at approaching multisensory, interactive actions. We may notice art-related schools, which were traditionally named the Art and Design departments, now introduce themselves as the Art and Media or the Art and Technology schools, with computing and programming described as a requisite both for the studies and future work.

**This Book as a Form of Entertainment**

Many agree that mental exercises make the best entertainment. Japanese prize-winning writer, Haruki Murakami (2011, p. 175), assumes that what may be called intellectual curiosity, a desire to obtain knowledge at the universal level, is a natural urge in people. Jean-Baptiste Dubos (1670-1742) wrote that man does nothing but what fulfills his needs; one of them is a need for keeping his own mind busy; otherwise, he becomes bored and unhappy:

*The soul hath its wants no less than the body; and one of the greatest wants of man is to have his mind incessantly occupied. The heaviness which quickly attends the inactivity of the mind, is a situation so very disagreeable to man, that he frequently chuses to expose himself to the most painful exercises, rather than be troubled with it.* (Dubos, 1717)

With Facebook becoming the most popular social networking site involving about a billion active users, Google being probably the Internet’s most visited Website, console gaming becoming a widely used instructional tool, and cinematic effects in motion pictures and games valued as motivational tools, we often consider play as a tool for learning, sharing, and entertainment. Within this template, learning can provide entertainment and amusement.
Dean Simonton (2003, 2004) points out that creativity of scientists is a constrained, stochastic, randomly determined behavior, as the new theories in all sciences are. When we realize that the results of our research are characterized by conjecture and accidental or unpredictable events (Simonton, 2004, p. 41), our curiosity may be enhanced. We cannot predict the results we can only know after computing them. Simonton reminds us of the Albert Einstein’s remark:

*It is, in fact, nothing short of a miracle that the modern methods of instruction have not yet entirely strangled the holy curiosity of inquiry; for this delicate little plant, aside from stimulation, stands mostly in the need of freedom; without this it goes to wreck and ruin without fall.* (Schlipp, 1951, p. 17)

Many would agree our thinking often depends on the tools we use; more areas are available for thought experiments by reason of the developments in technology. Tools may enhance our imagination. Thought activities are often shared, and thus become more entertaining, because almost everything we examine can be visualized. This allows creating technology-based entertainment such as films based on scientific books, worlds populated by avatars and beings existing in the past, the future, or in fictitious environments. Charles Jencks, an architect and writer questioning postulates expressed by the Modern architecture and describing its successors – the Late, Neo, and Post-Modern architecture, wrote:

*Whatever the reasons, contemporary science has not yet transformed the cultural landscape not led to a renaissance in thought... In any case, I believe that the ideas of contemporary science do provide the basis for a cultural reawakening and that a new iconography must be made more tangible through art if it is to be assimilated.* (Jencks, 2003, p. 20)

Nathan Yau (Lima, 2011, p. 248) describes the citizen science that is based on social data collection, “Although not everyone who ‘analyzes’ this data will have a background in the proper techniques, a certain level of data literacy must be developed. Visualization will be essential in making the data more accessible.” Yau (2011) emphasizes the engaging quality of interactive, flying data that he finds not only explanatory but also compelling and entertaining. Non-professionals become involved in visualization and analysis when they take on microblogging and engage with social applications like Twitter and Facebook. The task is to add structure and tools that take advantage of these open applications, to see the undiscovered relationships, and to interact with our surrounding.

**The Power of Visualization and Visualizing Thoughts**

According to the pioneer in the field of data visualization Edward Tufte (1983/2001), vision is the only universal language. Gyorgy Kepes (1906-2001), who published an influential book about design and design education *Language of Vision* (1944/1995, p. 13) wrote, “Visual communication is universal and international; it knows no limits of tongue, vocabulary, or grammar, and it can be perceived by the illiterate as well as by the literate.”

The Voyager, which is conveying the data about the heliosphere and the interstellar space, had sent into the deep space a gold-plated copper disk containing visual descriptions as a record of our civilization (Figure 1). A committee chaired by Carl Sagan of Cornell University selected the content of the record for NASA. The spacecraft may approach another planetary system in at least 40,000 years (NASA Jet Propulsion Laboratory, 2012).
Projects for the Reader

Themes for particular chapters in this book have been selected with several objectives in mind. First of all, descriptions of natural and technological processes are focused on visual ways of explanation. Second, the readers are invited to look at the underlying physical and natural laws and actively react to the nature- and science-derived facts and processes. Translation into the art and visualization oriented frames of thinking supports current methods of communication going through networked, linked, and shared media. Developments in science, technology, and art created with the use of a computer come in a great part from biology-inspired sources. As Gérard Battail (2009, p. 323) wrote, “Life is an outstanding expert in solving engineering problems.” The selected nature- and science-inspired themes are intended to encourage the reader to respond in one’s own way, by creating, designing, writing, and programming individual reactions to these themes.

Many of us scan and copy items or use Internet resources, and then apply filters to transform them into line drawings; many do not draw at all. We can see this trend in animations and feature films. Perhaps the meaning of drawing is different in electronic media, where images are interactive, linked, and open-ended. Paul Fishwick (2008, p. 4) defines aesthetic computing as “the application of the theory and practice of art to the field of computing.” For him, it is the study of artistic, personalized, formal model structures in computing that go beyond representation and events in technology.

The book tells about a number of nature-inspired projects, applications, and technologies, selected with a focus on visual way of communicating solutions. Readers will find framed spaces for their visual and verbal responses. The spaces left for reader’s thought and action are the decisive parts of this book; it is a place for novel, personal interaction in the form of drawing and writing. Combining selected fields of knowledge with practical applications in terms of the visual and verbal expression serves as a tool used to show the way of applying one’s visual way of solving particular tasks and to work on one’s
ability to do this. For these reasons, I see the tables with a space for the reader’s input as an inherent part of the book. This serves as a link between theoretical and practical application of visual literacy seen from a new perspective. The central aim of this book should not thus be misunderstood, neither as a research source suggesting new themes for other researchers nor as a collection of exercises for particular groups of people.

The goal of art therapists lies in helping people with problems at the cognitive, motor, emotional, and psychomotor levels, to name just a few. It is not necessary that “patients” fully comprehend this material, with its scope spanning from science, engineering, and computing to art concepts. This book is meant for those thinking at the higher, abstract thinking level, who grew to the point of opening themselves to current venues and experiences. Thus, the main thesis of the book is in proclaiming a need for shifting the readers’ thinking and acting towards creating visual explanations and solutions based on a selected knowledge base. Filling out by the reader each framed space adheres to the book’s intention.

Projects suggested in this book are meant to support visual way of thinking and developing visual communication with the use of visual semiotics by constructing signs, symbols, iconic objects, analogies, and metaphoric connotations, thus conveying some meaning in a visual way. The text is interlaced with projects to be solved by the reader within the boxes designated to their visual/verbal answer to the project. The empty boxes in the text are for sketches; the reader can sketch or can choose to continue working further on the computer. Projects are open-ended in nature and integrative. The sources for inspiration are contained within the background information provided, rather than in a description of an expected outcome. The reader may go any direction one would choose, look for answers on the Internet, or try to create something totally new. My students’ solutions accompany the text, along with the author’s visual solutions, which are printed black-and-white here.

Each project challenges you to react to a theme under discussion, add your input or modify the content, visualize the concept, and then complete your visual/verbal answer. Each empty space is a place intended for your planned idea for a project. First, you may want to describe it, to sketch, draw, design a concept map, or draw some key frames. Then you may feel ready for writing a program, designing a software application or an app for mobile devices, use graphic software, and create a picture or a sculpture (for example from wooden blocks or the found objects). Finally, you may want to make a photo or a short video of your project, post it online, thus adding your active, creative, independent solution or interpretation and explaining it to others. Your projects may take form of an artwork, a verse, a story, a concept map, animation, comics or manga, or a smart phone app.

The purpose behind these activities lies in their explanatory and motivational power to enhance one’s visual, graphical, and visualization literacy (both of the readers and of those who would look at their projects). Our environment and its changes influence our thinking and our acting, which we do mostly with the use of computing. For this reason, the following text tells about the connectivity between our daily life, knowledge, art, and entertainment. In a quest for things that last longer, people work on making materials indestructible and designing intelligent applications. This connectivity becomes even stronger because of the changes we experience when our knowledge about the world we live in becomes bio-inspired, nano-oriented, and progressively shared because:

1. The impact of biology-inspired knowledge, technology, and art is growing.
2. The focus on nanotechnology drives the advances in many domains and brings changes in materials, technologies, and applications, influencing each other.
3. The Web-based networking results in changing the way we now solve our problems (with the immediate help coming from often unidentified sources), entertain (we can enjoy gaming with people from far away), and develop in social media, new media art, or networked art (existing in real time and/or in virtual spaces).

4. Programming became accessible and easier due to the visual way of instruction such as processing, with free online instruction (such as HTML, free courses, Apple Developers’ kits, SDK – Software Development Kits, etc.), so the art creating often fuses with the manufacture, while the designing of games becomes an art medium.

In a quest for objects that would last longer, people work on making materials indestructible and designing intelligent applications. Projects interweaving the text are intended to associate knowledge with practical applications, facilitate the integration of particular facets of science that have been routinely segregated into special fields, and to follow the current advances in various areas. Our thinking may probably change not only with the technical progress but also with the experienced reality changing along with the advancements in technology and everyday life. Projects are aimed to hopefully engage the readers in practicing visual communication and visual organization of data and knowledge, with a focus on the meaning, not exclusively on data or numbers. When working on these projects, you may hesitate to look at or copy the ready examples, because copying may influence a person who copies and may have an impact on one’s personal visual statement. As a summary, the projects offered in this book will most likely prompt inspiration to find progressive solutions based on the informed way of thinking.

As a conclusive remark, with the advent of pervasive computing, with computer-mediated way of thinking and living at many fronts, one might ponder about a need for a talent search and support for all talents that could further advance our ways of living. Three issues come to mind:

1. A need for a free access to the Internet for everyone, disregarding all differences and levels, so every idea-driven and motivated individual could explore, learn, produce, and share knowledge and achievements. This issue seems to face similar obstacles as a free access to water.

2. A need for solving the image- and video-related copyright problems, so every author could freely illustrate one’s writings with visual examples, rather than provide complex, lengthy, and often short-living links. For that, an international agreement would be needed to address profit-based issues.

3. In regard to mining and supporting talents, training and education of children should be focused on recognizing and supporting the innate abilities of children. This would allow starting a holistic training of young minds by providing knowledge visualization early, that means from kindergarten (Figure 2). Knowledge visualization has a power to introduce an outline of major ideas and connections between science, mathematics, and programming.

Figure 2 conveys an opinion that before a child learns typical attitudes, misconceptions, and classifications, we can introduce a big picture as inspiration to finding their own interest, focus, and future path. Ongoing developments in computer graphics and visualization techniques may make us to reconsider the needs of education. With a shortage of programmers combined with usual fear of mathematics, programming, and science, one may consider knowledge visualization as a tool for showing the world at the time when attitudes are open and children’ brains are curious.
With the use of visualization techniques, themes related to science, nature, math, art, and how they mutually influence each other might be presented to young children as a big holistic spectrum of knowledge. We may instill abstract thinking in young children by supporting an understanding of the surrounding world, which would allow making connections. On the basis of openness to a wider picture, they may have a chance to shape their own, individual focus on what stirs their curiosity, in relation to other levels of knowledge. To enhance instruction with knowledge visualization component, early childhood specialists and departments would need to welcome knowledge visualization specialists on the board.

THE BOOK CONTENT

Section 1: Perceiving

Chapter 1: “Articulation and Translation of Meaning”

This chapter is about concepts of articulation and translation as the ways of exploring meaning. Articulation is discussed as units combined into complete structures and thus meaningfully expressed. The text includes examples of double and triple articulation of signs in languages, programs, and several other fields. Translation—another common thread interweaving distinctive processes and events—may include translation from nature to art (with the use of technology), as well as many forms of visual, verbal, and numeral translation. Two-way translation is discussed, from nature to idea and production (technical solutions) and from products to human perception and creation.
Chapter 2: “Communication through Many Senses”

Sensory messages are examined as electromagnetic waves clearly identified by our senses, consisting of interacting electric and magnetic currents or fields and having distinctive wavelengths, energy, and frequency. Further text discusses modes of gathering information and communication that include sensory responses to electromagnetic waves, visible vibrations exemplified by cymatics, the pitch response, the senses of vision, smell, touch, and taste, all of them further expanded by the developments in current technologies. The sense of numbers is examined next, involving numerical and verbal cognition and communication with the use of numerals. Sensitivity, spatial abilities, and the threshold of sensory information make a part of the issues about biology-inspired computational solutions for enhancing our particular or synesthetic abilities, and the role of imagination in biology-inspired research and technology, learning, and teaching. The role of the sensory input in art, which pertains in some extent to individual curiosity and sensibility, concludes the chapter.

Chapter 3: “Essential Art Concepts”

This chapter comprises a basic overview of visual literacy, computer art graphics, and visual communication design, basic art concepts, elements and principles of design in art, design, craft, and folk art, technical issues related to art and design, and the quality of display, among other topics. A short introduction of this kind may be useful for those focused on domains other than visual arts, and may be helpful for those readers who would like to be reactive to further themes. The advantage of visual displays of information over speech or writing is in its nonlinear and flexible time of viewing, multiple dimensions, and possibility of restructuring its content. The projects resulting from reading this book will hopefully display information aesthetically, with visible traces of reasoning about concepts.

Chapter 4: “Creativity, Intuition, Insight, and Imagination”

Notions such as art creation, creativity, and the creative process are changing in response to the developments in information technologies. Countless options of social networking provide fuel for many forms of online creative works. Comprehension of the role of creativity in new media art involving concepts beyond 2D and 3D graphics, such as interactive and time-based art, networking, online and Second Life presence, evoke initiatives taken in journals, books, college curricular programs, conferences, and the new options taken by artists and designers. This results in the quest of the new role of digital creativity and an emerging need for boosting digital creativity in schools. The text looks at the role of creativity in a process of digital art image creation.

Section 2: Visual Cognition

Chapter 5: “Cognitive Processes Involved in Visual Thought”

Cognitive thinking is discussed here in terms of processes involved in visual thought and visual problem solving. This chapter recapitulates basic information about human cognition, cognitive structures, and perceptual learning in relation to visual thought. It tells about some ideas in cognitive science, cognitive
functions in specific parts of the brain, reviews ideas about thinking visually and verbally, critical versus creative thinking, components of creative performance, mental imagery, visual reasoning, and mental images. Imagery and memory, visual intelligence, visual intelligence tests, and multiple intelligences theory make further parts of the chapter. This is followed by some comments on cognitive development, higher order thinking skills, visual development of a child, the meaning of student art in the course of visual development, and the role of computer graphics in visual development.

Chapter 6: “Semiotic Content of Visuals and Communication”

The semiotic content of visual design makes a foundation for non-verbal communication applied to practice, especially for visualizing knowledge. The ways signs convey meaning define the notion of semiotics. After inspection of the notions of sign systems, codes, icons, and symbols further text examines how to tie a sign or symbol to that for which it stands, combine images, and think figuratively or metaphorically. Further text introduces basic information about communication through metaphors, analogies, and about the scientific study of biosemiotics, which examines communication in living organisms aimed at conveying meaning, communicating knowledge about natural processes, and designing the biological data visualization tools.

Chapter 7: “Pretenders and Misleaders in Product Design”

This part of the book is about the meaningful message in product design and the use of pretenders in product design as the carriers of hidden messages that refer to visual practices in design and visualization. The notion of iconic objects, or iconcity of an object, makes a basis of product semantics. Proper design versus pretenders, misleaders, informers, double-duty gadgets, and multitasking tools are discussed and then contrasted with the notion of camouflage.

Chapter 8: “Metaphorical Communication about Nature”

Metaphors are present in our thoughts and make invisible concepts perceivable. The metaphorical way of perceptual imaging is discussed in this chapter, particularly the use of art and graphic metaphors for concept visualization. We may describe with metaphors the structure and the relations among several kinds of data. Metaphors may represent mathematical equations or geometrical curves and thus make abstract ideas visible. Most metaphors originate from biology-inspired thinking. Nature-derived metaphors support data visualization, information and knowledge visualization, data mining, Semantic Web, swarm computing, cloud computing, and serve as the enrichment of interdisciplinary models. This chapter examines examples of combining metaphorical visualization with artistic principles, and then describes the metaphorical way of learning and teaching with art and graphic metaphors aimed at improving one’s power of conveying meaning, integrating art and science, and visualizing knowledge.
Section 3: Tools for Translating Data into Meaningful Visuals

Chapter 9: “Visual Approach to Translating Data”

This chapter examines some of the tools that enable a visual approach to translating data, beginning with a comparison of the use of a computer versus pencil in visual communication. A short note follows, discussing the evolution of imaging with the use of computing: the history of computers and then some examples of graphic display and early computer-generated art works. This is followed by a discussion of the basic ways of graphical display of data and strategies for visual problem solving in the context of art and design. Thoughts on visual translation of data include an introduction to computer simulation. Examples of computer simulation and evolutionary computing conclude the chapter.

Chapter 10: “Digital and Traditional Illustration”

Traditional and computing-based illustrations make a great part of our everyday experience. This part of the book examines how traditional illustration types have found their continuation in computing-based media, even when the products mimic the old appearance. The next part includes several projects addressed to the reader and illustrated by student solutions, which refer to various fields of interests or areas of activities and apply selected illustration techniques.

Chapter 11: “Making the Unseen Visible: The Art of Visualization”

Themes and examples examined in this chapter discuss the fast growing field of visualization. First, basic terms: data, information, knowledge, dimensions, and variables are discussed before going into the visualization issues. The next part of the text overviews some of the basics in visualization techniques: data-, information-, and knowledge-visualization, and tells about tools and techniques used in visualization such as data mining, clusters and biclustering, concept mapping, knowledge maps, network visualization, Web-search result visualization, open source intelligence, visualization of the Semantic Web, visual analytics, and tag cloud visualization. This is followed by some remarks on music visualization. The next part of the chapter is about the meaning and the role of visualization in various kinds of presentations. Discussion relates to concept visualization in visual learning, visualization in education, collaborative visualization, professions that employ visualization skills, and well-known examples of visualization that progress science. Comments on cultural heritage knowledge visualization conclude the chapter.

Chapter 12: “Intelligent Agents: Interactive and Virtual Encounters”

Tools available for enhancing and sharing knowledge include intelligent agents, Augmented Reality (AR), and Virtual Reality (VR), among other solutions and paradigms. Collaborative computing became possible due to the advances in social networking, collaborative virtual environments, multi-touch screen-based technologies, as well as ambient, ubiquitous, and wearable computing. Examples of simulations
in various domains include virtual computing machines, transient public displays of the data, mining for
patterns in data, and visualizations of past events with the use of immersive technologies, virtual reality,
and augmented reality. Further discussion relates to the tools for creating and publishing interactive 3D
media and the Second Life culture.

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REFERENCES

r376x87u5mk68732/fulltext.pdf

from http://archive.org/details/criticalreflecti01dubouoft


ural Press.


spacecraft/goldenrec.html


Simonton, D. K. (2003). Scientific activity as constrained stochastic behavior: The integration of
2909.129.4.475 PMID:12848217.

Cambridge University Press. doi:10.1017/CBO9781139165358.


APPENDIX: SELECTED WEBSITES WITH ART WORKS SUPPORTING THE TEXT

Listed are some art related Web addresses that may support the text. While links become perishable, there are still Google Images available.

Figures in color and time-based works can be viewed at http://ursyn.com/student%20gallery/index.html; color figures have the QR codes (quick response codes) for the URL of the author’s Website.

- **Art History Resources on the Web**: http://arthistoryresources.net/ARTHLinks.html
- **Contemporary Art**: http://arthistoryresources.net/ARTHcontemporary.html
- **WEB Museum**: (Nicolas Pioch) http://www.ibiblio.org/wm/
- **SFMOMA ArtScope**: Established for exploring the Museum collection, http://www.sfmoma.org/projects/artscope/index.html#artwork=48370&r=73&zoom=4 shows art works from the San Francisco Museum of Modern Art; artwork images and descriptions pop-up
- **Whitney Museum**: http://www.whitney.org/
- **Whitney Artport**: http://artport.whitney.org - Artport is the Whitney Museum’s portal to net art and digital arts, and an online gallery space for commissioned net art projects.
- **Emerging Artistic Practices**: http://www.rhizome.org
- **National Gallery of Art, Washington, DC**: http://www.nga.gov/copyright/toc.htm
- **New Museum, New York**: www.newmuseum.org/

- **Published Reproductions of Art**:
- **Photoshop Resources**: http://sixrevisions.com/photoshop/70-excellent-photoshop-resources/