

Teaching Critical Thinking and Problem Solving Skills

Lisa Gueldenzoph Snyder

Mark J. Snyder

Abstract

Critical thinking is a learned skill that requires instruction and practice. Business education instructors at both the secondary and post-secondary levels can enhance students' critical thinking skills by (1) using instructional strategies that actively engage students in the learning process rather than relying on lecture and rote memorization, (2) focusing instruction on the process of learning rather than solely on the content, and (3) using assessment techniques that provide students with an intellectual challenge rather than memory recall. Several barriers can impede critical thinking instruction. Lack of training, limited resources, biased preconceptions, and time constraints conspire to negate learning environments that promote critical thinking. However, actively engaging students in project-based or collaborative activities can encourage students' critical thinking development if instructors model the thinking process, use effective questioning techniques, and guide students' critical thinking processes. The examples provided challenge instructors to think of students as users of information rather than receivers of information.

"It is possible to store the mind with a million facts and still be entirely uneducated."

~ Alec Bourne

Introduction

What is critical thinking, and why is it so important? The Critical Thinking Community defined critical thinking as "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (Scriven & Paul, 2007, p. 1). Critical thinking has also been referred to as metacognition (Tempelaar, 2006) or the process of "thinking about thinking" as defined and originally purposed by Flavell (1979). Critical thinking skills are important because they enable students "to deal effectively with social, scientific, and practical problems" (Shakirova, 2007, p. 42). *Simply put, students who are able to think critically are able to solve problems effectively.* Merely having knowledge or information is not enough. To be effective in the workplace (and in their personal lives), students must be able to solve problems to make effective decisions; they must be able to think critically.

Critical thinking is not a new concept. "Throughout nearly 300 years of policymaking in the United States, educators have promoted eight broad goals of schooling: basic academic skills, critical thinking and problem solving, social skills and work ethic, citizenship, physical health, emotional health, the

Dr. Lisa Gueldenzoph Snyder is an associate professor of Business Education in the School of Business and Economics at North Carolina A&T State University in Greensboro, NC.

Mark J. Snyder is an adjunct professor of Business Administration in the Love School of Business at Elon University in Elon, North Carolina.

arts and literature, and preparation for skilled employment” (Rothstein, Wilder, & Jacobsen, 2007, p. 8). Business education directly addresses work ethic and the preparation for skilled employment as well as critical thinking and problem solving. Yet many teachers continually struggle to engage students in critical thinking activities (Tempelaar, 2006), and students seldom use critical thinking skills to solve complex, real-world problems (Bartlett, 2002; Rippin, Booth, Bowie, & Jordan, 2002). Why?

The answer may be in our instructional methods. Two quotes that are often cited together reflect this supposition (as cited by Schafersman, 1991). First, Clement (1979) stated that “we should be teaching students how to think. Instead, we are teaching them what to think” (p. 1). Second, Norman (1981) noted that “it is strange that we expect students to learn, yet seldom teach them anything about learning” (p. 1). Although content is important, the process of how students learn the material is equally important. Therefore, the purpose of this article is to analyze and synthesize secondary research to provide best practices for incorporating critical thinking instructional methods into business education classrooms at both the secondary and post-secondary levels. First, critical thinking is described as it relates to instructional design. Then barriers to critical thinking are outlined. Finally, instructional strategies for enhancing students’ critical thinking skills are provided as well as examples of critical thinking in business education.

How Critical Thinking Relates to Instructional Design

*Those who have the ability to hear, do not always actively listen.
Similarly, those who have the ability to know, do not always critically think.*

The premise that critical thinking is to knowing as listening is to hearing implies that critical thinking is a learned skill that must be developed, practiced, and continually integrated into the curriculum to engage students in active learning. To support this premise, focused attention needs to be placed on the application of content, the process of learning, and methods of assessment.

In terms of the application of content, teaching techniques that promote memorization (often temporary knowledge) do not support critical thinking. Although some content, such as vocabulary definitions, do require memory, it is the application of the content that stimulates thinking. Instruction that supports critical thinking uses questioning techniques that require students to analyze, synthesize, and evaluate information to solve problems and make decisions (think) rather than merely to repeat information (memorize). Because critical thinking is a mental habit that requires students to think about their thinking and about improving the process, it requires students to use higher-order thinking skills – not memorize data or accept what they read or are told without critically thinking about it (Scriven & Paul, 2008; Schafersman, 1991; Tempelaar, 2006). Therefore, critical thinking is a product of education, training, and practice.

To link critical thinking skills to content, the instructional focus should be on the process of learning. How will the students *get* the information? Research supports the premise that lecture and memorization do not lead to long-term knowledge

or the ability to apply that knowledge to new situations (Celuch & Slama, 1999; Daz-Iefebvre, 2004; Kang & Howren, 2004). Traditional instructional methods use too many facts and not enough conceptualization; too much memorizing and not enough thinking. Therefore, lecture and rote memorization do not promote critical thinking. Instructional strategies that employ students' higher-order thinking skills lead to improved critical thinking skills (Duplass & Ziedler, 2002; Hemming, 2000; Wong, 2007).

Additionally, assessments should emphasize thinking rather than facts (Ennis, 1993). Graded assignments, quizzes, or tests should become intellectual challenges rather than memory recall (Schafersman, 1991). Subjective tools such as essay questions and case studies require students to apply their knowledge to new situations and are better indicators of understanding than objective true/false or standardized multiple-choice assessments. However, instructors can create multiple-choice questions that require critical thinking. For example, a question that asks students to identify the example that best applies a specific concept requires more critical thinking and analysis than a question that asks students to identify the correct term for a given definition. Ennis stated that although they are more labor intensive to create than equally effective open-ended critical thinking assessments, multiple-choice tests are easier to grade. To enhance students' processing skills, it is important to review test questions and explain correct answers by modeling the critical thinking process (Brown & Kelly, 1986; Duplass & Ziedler, 2002; Schafersman, 1991).

Barriers to Critical Thinking

Several researchers (Landsman & Gorski, 2007; Sandholtz, Ogawa, & Scribner, 2004; Sheldon & Biddle, 1998; Wong, 2007) suggest that the current educational trend to standardize curricula and focus on test scores undermines instructors' ability to address critical thinking in the classroom. The emphasis on "teaching to the test" distracts the learning process from student-centered instruction and places the emphasis on the content. If the focus is on learning, students should be given the freedom (and responsibility) to explore content, analyze resources, and apply information.

Unfortunately, students are not typically taught to think or learn independently, and they rarely "pick up" these skills on their own (Ladsman & Gorski, 2007; Lundquist, 1999; Rippen, Booth, Bowie, & Jordan, 2002). Critical thinking is not an innate ability. Although some students may be naturally inquisitive, they require training to become systematically analytical, fair, and open-minded in their pursuit of knowledge. With these skills, students can become confident in their reasoning and apply their critical thinking ability to any content area or discipline (Lundquist, 1999). Critical thinking is often compared to the scientific method; it is a systematic and procedural approach to the process of thinking (Scriven & Paul, 2007). Just as students learn the process of the scientific method, they must also learn the process of critically thinking.

Four barriers often impede the integration of critical thinking in education: (1) lack of training, (2) lack of information, (3) preconceptions, and (4) time

constraints. First, teachers often are not trained in critical thinking methodology (Broadbear, 2003). Elementary and secondary teachers know their content and receive training in the methods of instruction, but little if any of their training is devoted specifically to how to teach critical thinking skills. Post-secondary instructors pursue additional content-based instruction during graduate school, but often have no formal methodological training, much less skill-based instruction. Second, few instructional materials provide critical thinking resources (Scriven & Paul, 2007). Some textbooks provide chapter-based critical thinking discussion questions, but instructional materials often lack additional critical thinking resources.

Third, both teachers and students have preconceptions about the content that blocks their ability to think critically about the material. Preconceptions such as personal bias partiality prohibit critical thinking because they obviate analytical skills such as being fair, open-minded, and inquisitive about a topic (Kang & Howren, 2004). For example, many business educators still continue using two spaces after ending punctuation even though typeface experts have documented that today's proportional fonts are designed for one space (American Psychological Association, 2001, pp. 290–291; Chicago Manual of Style Online, 2007). A critical analysis of the information provided on this typesetting topic would support the use of a single space; however, strong biases for two spaces preclude many business teachers (predominantly typing teachers) from changing their opinion and adopting the acceptable procedure.

Finally, time constraints are barriers to integrating critical thinking skills in the classroom. Instructors often have a great deal of content to cover within a short time period. When the focus is on content rather than student learning, shortcuts such as lectures and objective tests become the norm. Lecturing is faster and easier than integrating project-based learning opportunities. Objective tests are faster to take (and grade) than subjective assessments. However, research indicates that lecturing is not the best method of instruction, and objective tests are not the best method of assessment (Broadbear, 2003; Brodie & Irving, 2007).

Instructional Strategies for Integrating Critical Thinking Skills

Even when the typical barriers are overcome, critical thinking requires more than simple engagement. It involves students' personal discovery of information. In a study investigating students' learning (Nokes, Dole, & Hacker, 2007), students who used heuristic techniques to solve problems consistently scored higher on content-based assessments than students who learned by traditional textbook and lecture methods. Heuristic teaching methods encourage students to "learn, discover, understand, or solve problems on [their] own, as by experimenting, evaluating possible answers or solutions, or by trial and error" (Dictionary.com, 2007, p. 1). A similar study suggested that problem-based learning activities promoted "critical thinking and problem-solving skills; active participation in the learning process including self-direction, identification of own learning needs, teamwork, creative discussion, and learning from peers; and the integration and synthesis

of a variety of knowledge” (Gurses, Acikyildiz, Dogar, & Sozbilir, 2007, p. 1). Kumar and Natarajan (2007) also found problem-based learning environments to increase students’ thinking skills and knowledge acquisition. A comparable concept is work-based learning. As noted by Brodie and Irving (2007), work-based learning (WBL) “is based on the inter-relationship and inter-dependency between understanding learning, critical reflection and the identification and development of capability within a WBL context” (p. 11).

Many business education researchers have addressed critical thinking. Rippin et al. (2002) investigated the use of case study methods in undergraduate business education courses. Braun (2004) focused on improving critical thinking methods in business education curriculum development. Celuck and Slama (1999) identified methods of integrating critical thinking skills into business courses. Other researchers (Catanach, Croll, & Grinaker, 2000; Saraoghu, Yobaccio, & Louton, 2000) studied hands-on activities that required students to think critically and apply their knowledge to specific tasks. In nearly all studies that suggested methods for integrating critical thinking skills, the elements of modeling, questioning, and guiding student practice were emphasized.

Modeling Critical Thinking Skills

Although business education students perceive critical thinking as an important skill (Davis, Riley, & Fisher, 2003), they typically do not know *how* to think critically. Students are not born with the ability to think *critically*, and their prior learning experiences often do not require them to think critically. Therefore, instructors who wish to integrate this skill in their classroom experiences must first model the behavior (Hemming, 2000). Students must learn how to think critically before they can apply the skill to content scenarios. Modeling can be demonstrated in a discussion setting by asking a question and “walking students through” the process of critically thinking.

Further, critical thinking activities should be based on a structure that includes four elements: “ill-structured problems, criteria for assessing thinking, student assessment of thinking, and improvement of thinking” (Broadbear, 2003, p. 7). Ill-structured problems are questions, case studies, or scenarios that do not have a definite right or wrong answer; they include debatable issues that require “reflective judgment.” For example, asking students to evaluate comparable websites, such as Wal-Mart and Target, requires them to think about the content of the websites, their format, and their usability. Right and wrong answers do not exist as long as the student’s choice is supported by logical reasoning.

The second element, criteria for assessing thinking, provides students with a framework for thinking about their thinking. *Why do you think Target’s navigational menus are easier to use than Wal-Mart’s? Why do you like one’s color scheme over the other? What is your perspective based upon?* Providing students with individualized feedback based on their responses allows them to address specific criteria upon which they can assess their thinking, which is the third element. If instructors model the criteria for assessing thinking and provide a framework, students will eventually apply these techniques on their own (Lundquist, 1999).

Finally, the process concludes with improvement of thinking. By creating a culture of inquiry where students can think about their thinking processes and practice logical constructs, students will become more willing to reconsider and revise their thinking (Duplass & Ziedler, 2002).

Questioning Techniques

In their research, Haynes and Bailey (2003) emphasized the importance of asking the right questions to stimulate students' critical thinking skills. Other researchers (Brown & Kelley, 1986; Hemming, 2000) also focused on integrating questioning techniques into class discussions to support an educational environment where students can demonstrate and practice critical thinking skills. Brown and Kelley's book, *Asking the Right Questions: A Guide to Critical Thinking*, documented the premise that students' critical thinking is best supported when instructors use critical questioning techniques to engage students actively in the learning process. Sample questions from all these studies include the following:

- What do you think about this?
- Why do you think that?
- What is your knowledge based upon?
- What does it imply and presuppose?
- What explains it, connects to it, leads from it?
- How are you viewing it?
- Should it be viewed differently?

These questions require students to evaluate the clarity and accuracy of their thinking as well as the depth and breadth of their thinking. Have they considered all the alternatives? Do they know why they think the way they do? Students need to determine whether the content they are using is relevant and if their thinking process is logical. By questioning their thought process, students can begin thinking about their thinking.

Research on questioning methodology also suggests that instructors should wait for student responses (Brown & Kelley, 1986; Hemming, 2000). Too often, the students' silence is filled by the instructor re-wording the question or asking a different student for a response. However, most students need at least 8 to 12 seconds to process and formulate their response, especially in critical thinking situations (Schafersman, 1991). If a question is based on rote memory recall, speed may be relevant; however, thinking requires time and patience. Give students the time they need to think critically.

Research also provides strategies for using questioning methods in online learning environments (Astleitner, 2002; MacKnight 2000). Discussion boards, virtual chat rooms, and instant messages provide forums for questioning and critical thinking. In synchronous environments, instructors can question students as they construct their responses. Although this is not possible with asynchronous communication, instructors can model the critical thinking process and assign activities that utilize questioning techniques and critical thinking responses. In all learning environments, it is important to guide students through the critical thinking process.

Guiding Students' Critical Thinking

When students are accustomed to being passive learners by merely memorizing and recalling information, it may be difficult at first to engage them in active learning situations that require critical thinking skills (Brown & Kelley, 1986). Instructors should be aware of students' initial resistance and guide them through the process to create a learning environment where students feel comfortable thinking through an answer rather than simply having an answer. For example, peer coaching techniques can engage students in active learning and critical thinking opportunities (Ladyshefsky, 2006). Assign students to two-person teams; one student is the problem-solver, and the other is the peer coach. Using the *Six Steps to Effective Thinking and Problem Solving*, or "IDEALS" (Facione, 2007), the problem-solver works through a case study or activity by responding to questions from the peer coach. The IDEALS are to Identify, Define, Enumerate, Analyze, List, and Self-Correct:

- I Identify** the Problem: *What is the real question we are facing?*
- D Define** the Context: *What are the facts that frame this problem?*
- E Enumerate** the Choices: *What are plausible options?*
- A Analyze** Options: *What is the best course of action?*
- L List** Reasons Explicitly: *Why is this the best course of action?*
- S Self-Correct:** *Look at it again ... What did we miss?*

This problem-solving technique guides students through the critical thinking process and utilizes learner collaboration. Similar strategies include integrating project-based learning activities that require students to apply their knowledge by constructing a real-world product. As a final guide to student practice, use peer assessments to facilitate students' critical thinking and meta-cognitive skills (Hou, Chang, & Sung, 2007).

Examples of Critical Thinking in Business Education

Many critical thinking strategies have been used successfully in business education courses at all levels. At the secondary level, Bartlett (2002) found that high school business students ranked critical thinking as the highest cognitive strategy. Shakirova (2007) analyzed the use of technology to support upper-grade students' critical thinking skills.

At the university level, Tempelaar (2006) investigated the role of critical thinking in business education programs and found a positive correlation between critical thinking (identified as a subset of metacognition skills) and course performance. Hannon, McBride, and Burns (2004) developed a critical thinking module in an undergraduate business studies program that used experiential exercises to enhance students' decision-making and conflict resolution skills.

Most research focused on collaborative learning activities to develop students' critical thinking skills (Yazici, 2004). For example, Ngai (2007) documented using a project-based team approach for an undergraduate e-commerce activity. Results from both student surveys and assessments indicated that students gained critical thinking skills based on the practical application of "learning-by-doing" and the collaborative effort required by the project. Dudley, Davis, and McGrady (2001)

also reported students' use of critical thinking skills when accounting students completed a group project involving the hypothetical creation of stock portfolios. A similar result was found when Whatley and Dyck (2000) applied International Monetary Fund development scenarios to international business topics with MBA students. The case method was also used by Rippen, et al. (2002) to provide students with the experience of practicing intervention skills and solving complex problems. With a little investigation and creativity, instructors can find resources that facilitate the integration of critical thinking activities into their courses.

Conclusion

The goal for business educators who want to instill critical thinking skills in their classrooms is to think of their students not as receivers of information, but as users of information. Learning environments that actively engage students in the investigation of information and the application of knowledge will promote students' critical thinking skills. However, as with any skill, critical thinking requires training, practice, and patience. Students may initially resist instructional questioning techniques if they previously have been required only to remember information and not think about what they know. They may struggle with assessment questions that are not taken verbatim from the book. However, by encouraging students throughout the process and modeling thinking behaviors, students' critical thinking skills can improve. The effort is worth the reward: students who can critically think for themselves and solve real-world problems.

References

- American Psychological Association (2001). *Publication manual of the American Psychological Association, 5th edition*. Washington, DC: American Psychological Association.
- Astleitner, H. (2002). Teaching critical thinking online. *Journal of Instructional Psychology, 29*(2), 53–77.
- Bartlett, J. E. (2002). Analysis of motivational orientation and learning strategies of high school business students. *Business Education Forum, 56*(4), 18–23.
- Braun, N. M. (2004). Critical thinking in the business curriculum. *Journal of Education for Business, 70*(4), 232–236.
- Broadbear, J. T. (2003). Essential elements of lessons designed to promote critical thinking. *Journal of Scholarship of Teaching and Learning, 3*(3), 1–8.
- Brodie, P., & Irving, K. (2007). Assessment in work-based learning: Investigating a pedagogical approach to enhance student learning. *Assessment & Evaluation in Higher Education, 32*(1), 11–19.
- Brown, M. N., & Kelley, S. M. (1986). *Asking the right questions: A guide to critical thinking, 7th ed.* Englewood Cliffs, NJ: Prentice Hall.
- Catanach, A. H., Croll, D. B., & Grinaker, R. L. (2000). Teaching intermediate financial accounting using a business activity model. *Issues in Accounting Education, 15*(4), 583.

- Celuch, K., & Slama, M. (1999). Teaching critical thinking skills for the 21st century: An advertising principles case study. *Journal of Education for Business*, 74(3), 134.
- Chicago Manual of Style Online (2007). Retrieved January 2, 2008, from <http://www.chicagomanualofstyle.org/home.html>
- Clement, J. (1979). Introduction to research in cognitive process instruction. In Lochhead, J. and Clement, J. (Eds.), *Cognitive process instruction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Davis, L., Riley, M., & Fisher, D. J. (2003). Business students' perceptions of necessary skills. *Business Education Forum*, 57(4), 18–21.
- Daz-Iefebvre, R. (2004). Multiple intelligences, learning for understanding, and creative assessment: Some pieces to the puzzle of learning. *Teachers College Record*, 106(1), 49–57.
- Dictionary.com (2007). Lexico Publishing Group, LLC, Retrieved January 2, 2008, from <http://www.dictionary.com>
- Dudley, L. W., Davis, H. H., & McGrady, D. G. (2001). Using an investment project to develop professional competencies in introduction to financial accounting. *Journal of Education for Business*, 76(3), 125–131.
- Duplass, J. A., & Ziedler, D. L. (2002). Critical thinking and logical argument. *Social Education*, 66(5), 10–14.
- Ennis, R. H. (1993). Critical thinking assessment. *Theory Into Practice*, 32(3), 179–186.
- Facione, P. A. (2007). *Critical thinking: What it is and why it counts*. Retrieved January 2, 2008, from <http://www.telacommunications.com/nutshell/cthinking7.htm>
- Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-development inquiry. *American Psychologist*, 34, 906–911.
- Gurses, A., Acikyildiz, M., Dogar, C., & Sozibilir, M. (2007). An investigation into the effectiveness of problem-based learning in a physical chemistry laboratory course. *Research in Science & Technological Education*, 25(1), 99–113.
- Hannon, S., McBride, H., & Burns, B. (2004). Developing creative and critical thinking abilities in business graduates: The value of experiential learning techniques. *Industry and Higher Education*, 18(2), 95–100.
- Haynes, T., & Bailey, G. (2003). Are you and your basic business students asking the right questions? *Business Education Forum*, 57(3), 33–37.
- Hemming, H. E. (2000). Encouraging critical thinking: “But...what does that mean?” *Journal of Education*, 35(2), 173.
- Hou, H., Chang, K., & Sung, Y. (2007). An analysis of peer assessment online discussions within a course that uses project-based learning. *Interactive Learning Environments*, 15(3), 237–251.
- Kang, N., & Howren, C. (2004). Teaching for conceptual understanding. *Science and Children*, 42(1), 28–32.
- Kumar, M., & Natarajan, U. (2007). A problem-based learning model: Showcasing an educational paradigm shift. *Curriculum Journal*, 18(1), 89–102.

- Ladyshevsky, R. K. (2006). Peer coaching: A constructivist methodology for enhancing critical thinking in postgraduate business education. *Higher Education Research and Development*, 25(1), 67–84.
- Landsman, J., & Gorski, P. (2007). Countering standardization. *Educational Leadership*, 64(8), 40–41.
- Lundquist, R. (1999). Critical thinking and the art of making good mistakes. *Teaching in Higher Education*, 4(4), 523–530.
- MacKnight, C. B. (2000). Teaching critical thinking through online discussions. *Educause Quarterly*, 23(4), 38–41.
- Ngai, E. W. T. (2007). Learning in introductory e-commerce: A project-based teamwork approach. *Computers and Education*, 48(1), 17–29.
- Nokes, J. D., Dole, J. A., & Hacker, D. J. (2007). Teaching high school students to use heuristics while reading historical texts. *Journal of Educational Psychology*, 99(3), 492–504.
- Norman, D. A. (Ed.) (1981). *Perspectives on cognitive science*. Hillsdale, NJ: Erlbaum.
- Rippen, A., Booth, C., Bowie, S., & Jordan, J. (2002). A complex case: Using the case study method to explore uncertainty and ambiguity in undergraduate business education. *Teaching in Higher Education*, 7(4), 429.
- Rothstein, R., Wilder, T., & Jacobsen, R. (2007). Balance in the balance. *Educational Leadership*, 52(8), 8–14.
- Sandholtz, J. H., Ogawa, R. T., & Scribner, S. P. (2004). Standards gaps: Unintended consequences of local standards-based reform. *Teachers College Record*, 106(6), 1177–1202.
- Saraoghu, H., Yobaccio, E., & Louton, D. (2000). Teaching dynamic processes in finance: How can we prepare students for an age of rapid and continual change? *Financial Practice & Education*, 10(2), 231.
- Scriven, M., & Paul, R. (2007). *Defining critical thinking*. The Critical Thinking Community: Foundation for Critical Thinking. Retrieved January 2, 2008, from http://www.criticalthinking.org/aboutCT/define_critical_thinking.cfm
- Schafersman, S. D. (1991). An introduction to critical thinking. Retrieved January 2, 2008, from <http://www.freeinquiry.com/critical-thinking.html>
- Shakirova, D. M. (2007). Technology for the shaping of college students' and upper-grade students' critical thinking. *Russian Education & Society*, 49(9), 42–52.
- Sheldon, K. M., & Biddle, B. J. (1998). Standards, accountability, and school reform: Perils and pitfalls. *Teachers College Record*, 100(1), 164–180.
- Tempelaar, D. T. (2006). The role of metacognition in business education. *Industry and Higher Education*, 20(5), 291–297.
- Whatley, A., & Dyck, L. (2000). A postmodern framework for developing critical thinking skills: The international monetary fund as a live case. *Journal of Teaching in International Business*, 11(4), 23–38.
- Wong, D. (2007). Beyond control and rationality: Dewey, aesthetics, motivation, and educative experiences. *Teachers College Record*, 109(1), 192–220.
- Yazici, H. J. (2004). Student perceptions of collaborative learning in operations management classes. *Journal of Education for Business*, 80(2), 110–118.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.