Why I Am So Fond of the Sokoban Logic Puzzles

Children enjoy thinking. One of the miracles of microcomputers is that they can help younger and older children develop an appetite for logic puzzles.

When I first saw the Sokoban logic puzzles, I quickly became fascinated in trying to solve them myself. But the 50 original puzzles are so very difficult that it took me three weeks (and about 25 hours of thinking) to reach puzzle number 12.

At that point it occurred to me that if the puzzles were made easier, they would have a strong appeal to children as well as adults. The directions for Sokoban said that it was possible to design your own puzzles using a word processor or text editor.

Ever ambitious to try something new, I spent two or three hours designing my first "simple Sokoban" puzzle. But it soon occurred to me that I could far more easily modify existing Sokoban puzzles than to design my own "simple Sokoban" puzzles from scratch.

I was especially intrigued in simplifying the existing puzzles into various "sub-puzzles," so that children who played each of the "sub-puzzles" would then have a fighting chance to attempt the original, "full" puzzles.

Also, it made sense to have a series of "similar form" puzzles, where kids could say to themselves, "Gee, this puzzles looks somewhat similar to the puzzle I just solved. Let me try and discover what extra steps I need to do to solve this variation of the puzzle I just solved."

There's a special appeal in playing logic games where each new puzzle is slightly more difficult than the last. In the 1990 book, The Art of Human-Computer Interface Design, educational software designer Joyce makes the following remarks: "Kids love the challenge and excitement of games. When a games is appealing and provides steadily increasing levels of difficulty, a child's interest lasts for a long time." (p. 124). When a logic puzzle is inherently appealing, children will have an inner motivation to want to solve increasingly more difficult versions of that particular type of puzzle.

One of the reasons I find the Sokoban puzzles so especially interesting is

that the puzzles can help students develop the type of visualization and spatial reasoning skills that could serve them well

when they later study high school and college physics. Not only can the puzzles help students learn about the concept of "forces acting on a body," but the puzzles can also help sharpen and hone students analytical abilities.

A few years ago educational researchers spent time interviewing college physics professors to find out the types of intellectual skills students should possess before studying physics. New York City researcher Arnold Peltzer wrote a 1988 article on this subject in the Journal of Research in Science Teaching. In that article, titled: "The Intellectual Factors Believed by Physicists to be Most Important to Physics Students," Peltzer concluded that, "four general intellectual factors are most important to physics students. They are the ability to reason in terms of visual images (visualization), mathematical insight (mathematics), the ability to evaluate the logic of arguments (logic), and the ability to attack problems in potentially productive ways (problem solving)." (p. 726). Volume 24, No. 9.

Peltzer goes on to comment that the development of these four skills in younger students could pay handsome dividends five or ten years later when they tackle formal physics: "Science curricular from the earliest grades through high school physics could incorporate the cultivation of these four intellectual skills as explicit goals. Monitoring the growth of these intellectual abilities would give a developmental focus to science education to complement the teaching of the subject matter of science." (p. 730).

Other researchers into this subject have arrived at parallel conclusions. In an article titled, "Enhancing the Visuo-Spatial Aptitude of Students," also published in the Journal of Research in Science Teaching, commentator Thomas R. Lord concludes: "It is the job of our schools to develop the cognitive potentials of its student population --- potentials that include the mental formation and manipulation of images. This study has found that a student's visuo-spatial cognitive potentials can be enhanced through carefully planned interactions. It is hoped that those responsible for creating the course curriculum for our schools include exercises that encourage spatial thinking." (p. 404). Volume 22, No 5.

Problem solving skills have also received renewed emphasis by the National Council of Teachers of Mathematics (NCTM). In their 1989 "Curriculum and Evaluation Standards for School Mathematics," the NCTM urge that general problem solving skills be incorporated into the elementary and middle school curriculum. The NCTM believes that younger students

should be given practice solving problems so

that they develop a capacity to: "develop and apply strategies to solve a wide variety of problems." And once children develop a capacity to solve simple problems, they then "acquire confidence in using mathematics meaningfully."

Similarly, the NCTM urges middle school students to have exposure solving "multistep and non-routine" problems. The Sokoban puzzles fit in well with the NCTM prescription for middle school students. The more difficult puzzles require multistep reasoning capability, and present students with many unique, non-routine problems.
For that matter, the easier Sokoban puzzles fill the bill well for elementary level students. These easier puzzles are a gentle introduction to logical reasoning, with the benefit that each solved puzzle helps boost a child's confidence in tackling logic problems.

All in all, the Sokoban puzzles are an interesting, engaging way to introduce students to logical problem solving. Once students develop a basic mastery skill at playing the puzzles themselves, they can then try their hand at designing their own original puzzles. Puzzle design, itself, is a skill that calls for an interesting blend of creative and analytical skills.

Thanks are owed to Ingemar Ragnemalm, an inspired Macintosh programmer in Sweden, for creating this freeware Macintosh version of Sokoban. Ingemar deserves special recognition for creating and distributing this highly useful educational program. Showing an exemplary public spirit, Ingemar has spent many extra hours adding and enhancing this freeware program over the past two years. Children and adults around the country, and abroad, are the grateful beneficiaries of Ingemar's work.

Phil Shapiro
September, 1993.

Recommended reading:

Laurel, Brenda, ed., The Art of Human-Computer Interface Design, Addison-Wesley, Reading, Mass., 1990, 523 pages, softcover, $26.95, ISBN 0-201-51797-3