Life and Death on the Go Board

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It is reported that on his deathbed, a wise Chinese philosopher remarked that if he could live his life over again he would dedicate half of it to playing Go. The twentieth-century Japanese Go champion, Kaoru Iwamoto, commented only somewhat facetiously that the philosopher seemed to lack any real enthusiasm for the game by promising to dedicate such a small part of his life to Go.

The ancient Asian board game, Go, has been revered as the ultimate game of intellectual and aesthetic enlightenment for millennia. Originating in China or Tibet about 4000 years ago where it was known as Wei Chi (or Game of Encirclement), the game spread to Korea and then Japan along with other Buddhist practices and beliefs about the year 500 C.E. The game flourished in Japan where it spread from the Buddhist priesthood and the court aristocracy to the samurai class and then to the population at large. Along with music, calligraphy, and painting, Go was considered one of the essential four arts that a well-educated citizen should cultivate.

Today the game is played by more than 30 million enthusiasts worldwide and by a growing number of professional players in Japan, China, and Korea who compete in lucrative tournaments and televised matches to appreciative Asian audiences. In addition to prestigious national titles and championships there are now several annual international championships sponsored by multi-national corporations such as Fujitsu Limited, the Ing Foundation, and the Tongyang Securities Company. There are, of course, a far larger number of strong amateur players with a host of tournaments played throughout the globe—some over the internet. The top amateurs representing over fifty nations compete in the annual World Amateur Go Championship. As you might expect, the individual winner is usually from either China or Japan, but players from the West have been faring better every year.

Like mathematics, Go originates in simple elements that lead naturally to unfathomable complexity. Its basic structure is intellectually pleasing and elegant and it encourages and rewards careful thinking, long-range planning, and deep problem-solving skills. Both pursuits involve unlimited creativity within a rigid structure. In both disciplines, there is a strong sense among practitioners that they are uncovering deep universal truths rather than creating temporary or artificial forms. Both mathematics and Go have a rich and fascinating history peopled with brilliant practitioners whose profound insights serve as inspirations to all those who follow. Furthermore, in both pursuits the joy of discovery and the thrill of self-improvement serve as grand incentives and a source of perpetual rewards.

Fortunately, one does not have to choose between these two beautiful realms. You can be a mathematician *and* a Go player! Okay, so how do you play?

The game is played on a 19 by 19 line grid laid out on a rectangular wooden board. The board starts out empty. Two players (black and white) alternately place identically shaped lenticular "stones" of their own color on the board beginning with black (in these illustrations we use blue for greater visual effect). The object is to safely surround the largest total area. Stones can connect horizontally or vertically with friendly stones of the same color, but can also be captured if they lose all their "breathing spaces" to the opponent's stones. Each competitor's final score is actually the total number of empty intersections surrounded by that player's stones minus the number of his or her stones which were captured. Let us illustrate further.

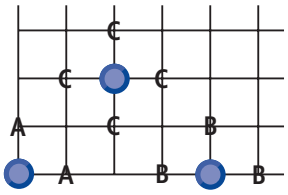

Figure 1. Liberties
The blue stone in the corner has two liberties (or breathing spaces) marked A. Once white has occupied both of them, the blue stone would be removed from the board by white and kept as a prisoner until the end of the game. Similarly the stone on the bottom edge has three liberties (marked B), and the stone in the middle has four liberties (marked C).

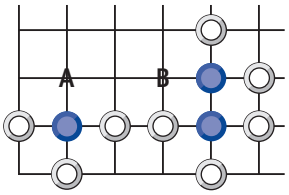

Figure 2. Capture
The single blue stone is in *atari,* which means it has just one remaining liberty. If white plays at A, then the blue stone will be removed. Similarly, the two blue stones on the right are in atari since five out of their six liberties are taken. If white plays at B, the two blue stones are removed together.

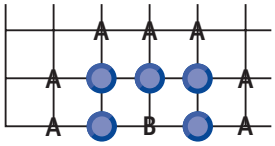

Figure 3. An Eye
The group of blue stones have eight liberties, seven external liberties (marked A) and one internal liberty (marked B). White must play all the points marked A before playing B in order to remove the blue stones. The reason that B must be played last is that "suicide is illegal," that no stone can be played where it has no liberties. After white makes all the A moves, a white move at B would be legal since the blue stones would be removed from the board as part of white's last move.

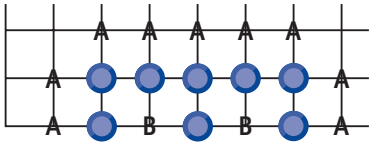

Figure 4. Two Eyes
All the blue stones are part of one group (connected along vertical or horizontal lines). However, unlike the blue group in Figure 3 which has one "eye," this group has two "eyes." Once white has played at all the points marked A, blue still has two internal liberties (B). However, white cannot play at either one since to do so would be an illegal suicide move. That is, white needs to play both in order to remove any blue stones, but cannot do so. Hence the blue stones are alive and blue has two points of territory.

On any given turn, a player may "pass" rather than place a stone if he or she cannot find a constructive move to make. In keeping with the polite etiquette of the game, a Go game ends when both players pass in succession.

The rules are quite simple and elegant, but give you little understanding of how a game is played. Figure 7 shows a sample game on a 9 × 9 board. Play through the game in order (from move 1 to move 42) with paper and pencil or with a real board and stones. Beginners usually learn to play on quarter boards where long-range strategic concepts do not play a significant role.

To improve at the game, one must play hundreds and even thousands of games, carefully replay the games of experts, and spend endless hours studying opening play, tactics and strategy, proper shape and form, and working out localized life and

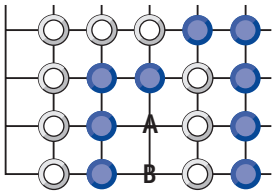

Figure 5. Seki
Blue has four stones surrounded by white stones and white has three stones surrounded by blue stones. If either blue or white plays A or B, the opponent will play the other point and capture. This is a *seki* (or impasse) where neither player will play here. At the end of the game, all the stones are alive, but neither point (A nor B) counts as territory for either player.

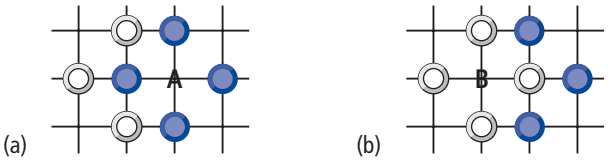

Figure 6. Ko rule
(a) shows a *ko* situation. White can play at A and capture a blue stone. The situation would then look like (b). It would appear that blue could immediately play back at B, capturing a white stone and returning the board to (a). Conceivably this could go on indefinitely. (The word ko is a Buddhist word meaning eternity.) The ko rule states that on the next turn after white first takes at A, blue has to play somewhere else on the board instead of at B. On blue's subsequent turn, blue could then capture white by playing at B if white hasn't filled in that point in the meantime. So the ko rule states that a player must make an intervening move before returning to a particular ko.

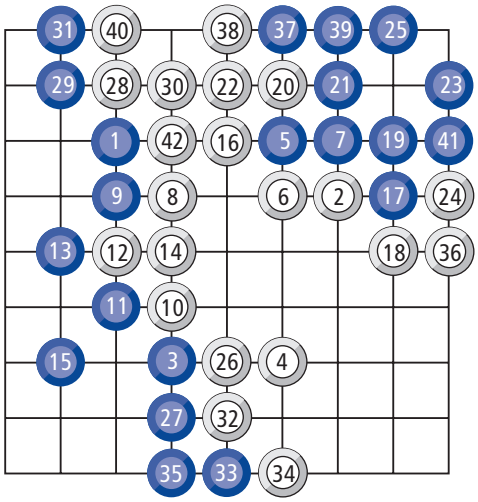

Figure 7. A 9 × 9 game
Blue's plays are odd-numbered and white's are even-numbered. At the end of the game all the blue stones and white stones are alive. White wins with 20 points of territory to blue's 19 points. For blue to place any additional stones on the board would simply subtract from his own territory or add a prisoner for white to take (and similarly for white). So blue passed for move 43 and white passed for move 44, thus ending the game.

death problems (known as *tsume-go* problems in Japan). In one such type of problem, the *status* problem, the reader must determine if a given group of blue stones are dead, alive, or unsettled. A dead group is one where perfect play by both players would result in the capture and removal of the group even if blue were to play first. An alive group is one where perfect play results in a living group even if white plays first. An unsettled group is one where the life or death of the stones depends on whose turn it is to play. In an actual game, players are usually in no rush to play where the stones are completely settled (alive or dead), but rather choose to play where groups are unsettled. Of course, in a real game there are many individual groups and the life or death of some groups might be subtly interconnected. In addition, timing and the proper order of moves is essential. So determining the next best move in a game often involves as much art and intuition as logic and deduction. But in a *tsume-go* problem the answer is generally definitive (though usually not at all obvious).

Here is a standard beginner's problem. What is the status of the blue group below? Think about the answer before reading the subsequent explanation.

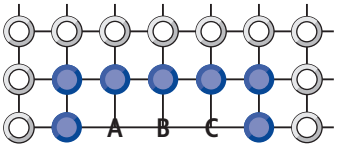

Figure 8. Eye space of three in a row
The blue group is unsettled. A blue play at B would create a live group as in figure 4. If white gets to play B first, then blue will be dead. (In theory, next white plays at A, blue plays at C capturing two white stones, then white plays at A putting blue in atari, and if blue plays B, then white plays A removing all nine blue stones. Blue cannot improve his outcome by playing at A or C after white's play at B. (Can you see why?) Hence in practice, when white first plays at B, the players leave the situation as is until the end of the game, at which point the seven blue stones are removed as white's prisoners.)

Go proverbs are a large part of the heritage of Go and help the student to gain insights into the game. Figure 9 illustrates, "an eye-space of four in a row is alive" and Figure 10 is summarized by the proverb "rectangular six is alive." Other proverbs serve as more general guidelines. Some examples are, "don't throw good stones after bad," "don't touch stones you want to attack," "the weak player pushes without thinking," and "the opponent's key point is your own." And of course there are more spiritual and enigmatic maxims such as, "watch the fire from the opposite shore" and "close the door to capture the thief."

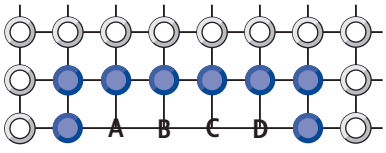

Figure 9. Eye space of four in a row
A white play at either B or C is met with a blue play at C or B respectively (making two safe eyes). So blue is alive with four points of territory.

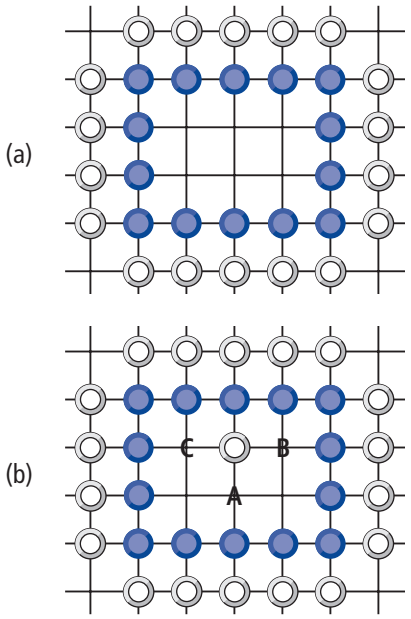

Figure 10. Rectangular six in the middle of the board
In (a), blue has surrounded a 2×3 rectangle consisting of six open points. If white plays in the center as in (b), then blue should respond at A. Now white B is met by blue C and vice versa. So blue's group is alive. (This diagram might take a bit more thought than some of the previous ones.)

Just for fun, Figure 11 shows one final life and death problem. What is the status of the blue group?

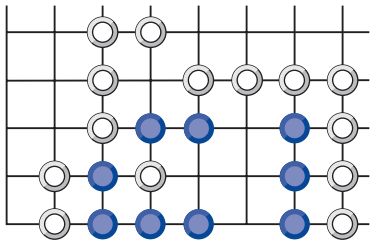

Figure 11. Challenge Problem
White has to find a way to capture all of blue's stones. (See solution on p. 23.)

Almost all devotees of the game of Go develop a philosophical sense of the game and it becomes deeply rooted in their psyche and sense of themselves. Players can often tell when their opponent is somewhat timid, too greedy, or overconfident. From July 21 to 25, 1846 two of the world's greatest players, Kuwahara Shusaku (blue) and Gennan Inseki (white) played a highly anticipated, long arduous match. Professionals watching the game could not tell who was winning, but a doctor at the event said he knew Shusaku was going to win. When pressed how he knew, he replied that once Shusaku played move 127, Gennan's ears turned red belying his calm

demeanor. As predicted, in the end Shusaku was victorious and this game has come to be known as the "ear-reddening" game.

To get some sense of the seriousness and single-minded dedication to the game, an excellent source is *The Master of Go* by the Nobel Prize winning author Yasunari Kawabata. The book chronicles the actual "retirement" match between an old grand champion and the best of the rising young stars at the time. This one game began in June of 1938 and lasted until December! I'll let you read the account of the game if you wish to find out who won.

The Japanese professional Chizu Kobayashi has said that "the Go board is [her] mirror, when her mind is cloudy and confused, she cannot see [her] face." It is reported that on his deathbed, a wise Chinese philosopher remarked that if he could live his life over again he would dedicate half of it to playing Go. The twentieth-century Japanese Go champion, Kaoru Iwamoto, commented only somewhat facetiously that the philosopher seemed to lack any real enthusiasm for the game by promising to dedicate such a small part of his life to Go. Iwamoto himself participated in a famous game played on the outskirts of Hiroshima on August 6, 1945—the day of the atomic bomb attack. After the shock wave blew out the windows and knocked the board and players on the floor, the game was immediately reassembled and Iwamoto went on to win.

Of course one must decide for oneself how deeply to dedicate your energy, mind, and spirit to either mathematics or the game of Go, but in my view any time invested is time well spent indeed. ■

For Further Reading

An excellent introduction to the rules of the game including a full-board example game is *The Magic of Go* by Cho Chikun. It also has brief but informative essays on professional Go in Japan, China, and Korea. As previously mentioned, Yasunari Kawabata's *The Master of Go* is a superb novel about a famous Japanese Go contest and the struggle between tradition and change. To sharpen your Go technique step by step work through the 1377 problems in Kano Yoshinori's, *Graded Go Problems for Beginners*, Vols. I–IV. The book is divided into subsections such as "How to capture stones," "How to save endangered stones," "Living groups and dead groups," and so on. Another very nice and leisurely way to learn about Go and deepen your understanding of the game is Janice Kim's and Jeong Soo-hyun's, *Learn to Play Go*, Vols. I–IV. To learn more about the game, where you can meet other Go players in your area, and other Go-related resources contact the American Go Association on line at `www.usgo.org`.