What is this, and how can you help?

The following pages contain a short and dense article about a board game. I am writing this (and similar texts for some other games) for basically two reasons:

1. I want to popularise cool board games which are less popular than they should be.
2. There are many accounts (books, online pages etc.) that just give the rules. In order to encourage more people to give them a shot, I'd like to go into a little depth: elementary tactics, problems etc. Hopefully, this helps drawing some future players!

I'm a moderately advanced Go player (1 dan) but not nearly an expert on any of the games I am writing about. Therefore, I will be happy and very grateful for all kinds of feedback. If you think I am way off the mark, please tell me! Remember, the more specific your feedback, the more I can improve the article.

Here are some features that the text is still lacking, but ideally would have:

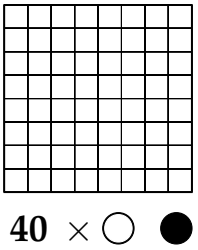
1. **Problems:** Please have a good look at the problems in the text. Are they well-posed? Do you have ideas for other and/or better problems? (Customarily, problems have unique solutions. I'm not even sure if my current problems have this property.)
2. **More heuristics:** good strategy games have heuristics that allow players to break up the complexity into more manageable pieces. There's not much literature on these games, so I've been starting out in the most simple fashion. If you are using other concepts, please tell me!
3. **Example positions:** if you have encountered a particularly surprising move (by yourself, an opponent, or someone else), feel free to send me the position; most easily as screenshot or LittleGolem link.

I already got some feedback through LG and BGG, and the article has greatly benefited from that. If you would like to comment, these are the best options:

- right in this thread,
- an email to `dploog@math.fu-berlin.de`. Please mention the game in the subject.

Many thanks for reading this! April 7, 2019

SLITHER

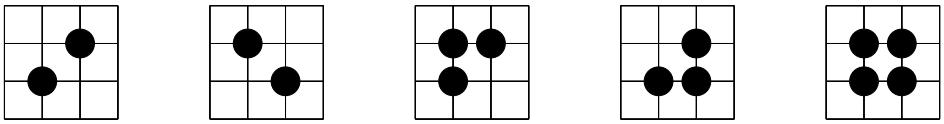


The game takes place on a board with 9×9 intersections.
Initially, the board is empty. Black has the first turn. The swap rule is used.

Each turn consists of one or two actions on stones of that player's colour:

1. The player **may move** a stone to an empty adjacent point, orthogonally or diagonally.
2. The player **must place** a stone on an empty point.

After a complete turn, the following **diagonal condition** has to be met: if two same-colour stones are diagonally adjacent, then at least one of the two common adjacent intersections has to contain a stone of that colour. A player unable to carry out a regular turn, has to pass.

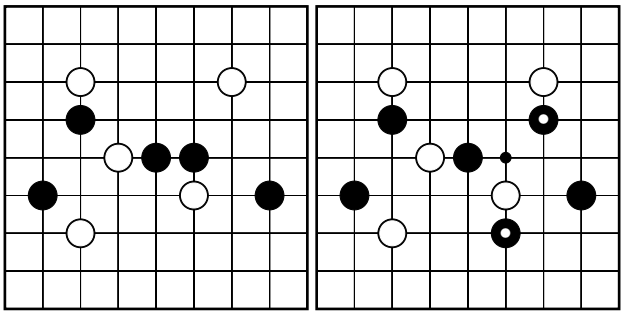


not allowed *not allowed* *allowed* *allowed* *allowed*

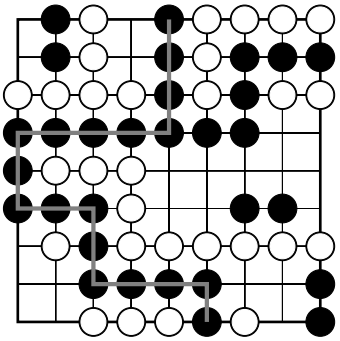
The game is won by forming orthogonal chains connecting opposite borders:

- White **wins** with a white chain connecting the left and rights borders.
- Black **wins** with a black chain connecting the upper and lower borders.

Diagrams explaining the rules



Black's turn: before *after.*
*A player **may move** one stone to an adjacent empty point (also diagonally) and **must place** a new stone on an empty point.*



*Blacks **wins** by connecting the top and bottom rows. White needs a horizontal connection.*

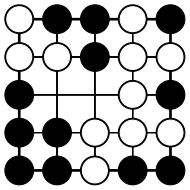
Corey Clark (2010)

Remarks and comments about gameplay

SLITHER has a high appeal for new players: the players' chains of stones grow and squirm across the board, like worms. Even though movement is slow, the game is surprisingly dynamic — in sharp contrast to pure placement connection games such as HEX or HAVANNAH.

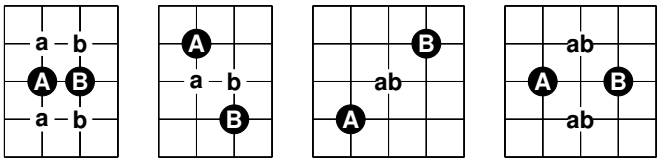
On the other hand, some players have trouble assessing the value of individual moves. This might be a sign of low clarity, yet we argue that SLITHER is interesting rather than opaque. We'll try to lift the fog a little.

Stalemate. There are positions in which a player is unable to carry out a turn. Such positions are extremely unlikely to occur in actual games. The diagram shows a small, contrived example.
However, it has been proven that in any position, at least one side has a turn [A]. This is why the passing rule makes sense. Examples like this one, artificial as they are, show that in SLITHER, your own stones can come back to bite you — if the bottom white stone weren't there, White could win! This is a nifty feature, and we'll start our discussion with the simplest cases.

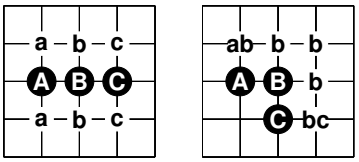


White has no turn, and must pass.

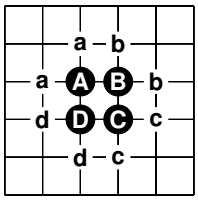
Consequences of diagonal prohibition. Nearby, same-coloured pieces incur restraints on movement and placement. We first consider two stones. For diagonal prohibition to restrict movement, the local shape has to look like in one of the following four positions:



In each diagram, the stone Ⓐ *cannot* move to points marked *a* due to the presence of Ⓑ, unless supported by an adjacent placement; likewise Ⓑ cannot move to *b* on its own. Except for the first diagram, Black cannot place a stone on the marked points either without movement.
The two right-hand diagrams have points marked *ab* which means that neither stone can move there. Hence Black can only get a stone on a point marked *ab* by spending both parts of the turn (movement and placement) in that area — *ab* points are annoying sources of inflexibility!
By contrast, the first two diagrams have no *ab* points, so that any point around Ⓐ and Ⓑ can be reached via movement, although sometimes by only one of the stones. In particular, the knight's jump configuration has just one of *a* and *b*, making it the most flexible among two stone patterns. This is why the knight's jump is very popular in the opening.
Of course, tactical necessities — the need to advance one's own connection and to block opposing connections — will often trump these considerations and before long, more tightly packed configurations will arise. Let us look at the line of three and at the triangle:



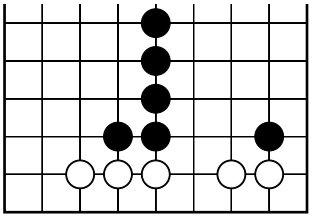
line of three *triangle*



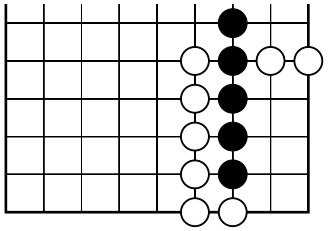
square

Note the high inflexibility of the triangle's central piece Ⓑ. Thus, triangles are a cumbersome pattern which should only be played for a tangible purpose. In a pinch, one can sometimes deal with an empty triangle by adding another stone, forming a square. This shape is inefficient for connecting or blocking, but it does enable quite flexible movement.

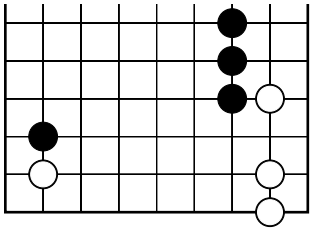
Three local connection problems: *Black to play and reach the bottom!*
In order to test and improve your reading ability for SLITHER, we start off with some problems emphasising local shapes in isolation: in each diagram, Black's chain dangling from above is supposed to connect to the bottom. The problems get increasingly harder.



Problem 1.

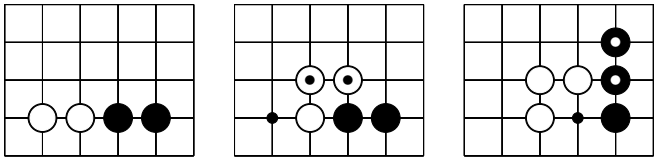


Problem 2.



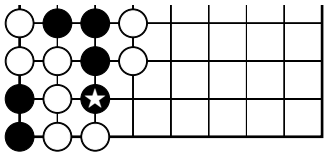
Problem 3.

Blocking along with the enemy. This is a very useful shape: a block of two stones in direction of the opposing win condition is quite versatile. No matter which way the opponent tries to bend around the defending pair, proper movement and placement can lead to a solid three line obstacle, now with attacking potential:

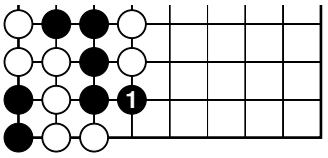


Versatile: Black is blocking in White's direction.

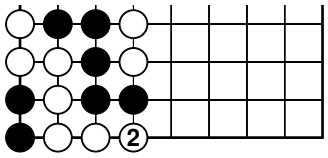
Ladders come up in GO as a tactical situation where the fate of a stone or chain is decided by a possibly very long sequence which, however, is a one-way street. Some edge fights in SLITHER have a similar quality, and we call the structure in the right-hand diagram an *edge ladder*:



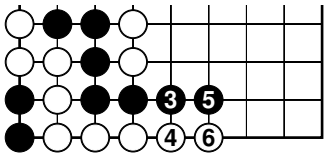
Can the ✪ chain reach the bottom?



The only placement for ❶.



Same for ②.

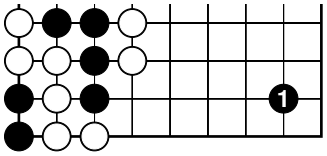


And so on…

We see that the *placements* in this fight are fixed, they have to prolong the emerging lines. Since the movement actions are still free, this means that stones in the vicinity make or break the

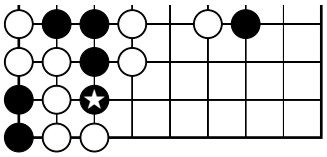
ladder. In the above diagrams, this is the whole lower right area. Note that the two white stones above ❶ are too slow to affect the ladder but White wins it anyway. Also note that Black is forcing White towards a connection, so be careful.

Since the ladder in the original diagram does not work for Black, it is pointless to start it. Instead, Black could place a stone somewhere in the lower right, threatening the ladder instead of activating it. This is called a *ladder enabler* and a useful device.

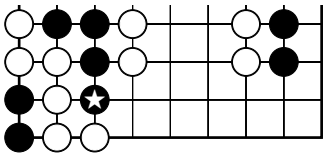


Black plays ❶ as a ladder enabler.

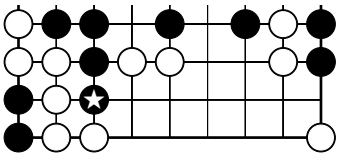
Three edge ladder problems: *Black to play. Can Black ✪ reach the bottom?*



Problem 4.



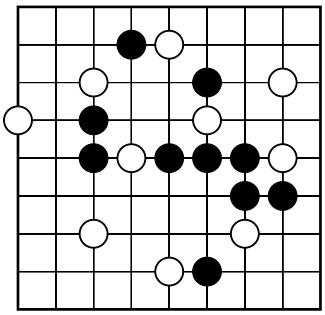
Problem 5.



Problem 6.

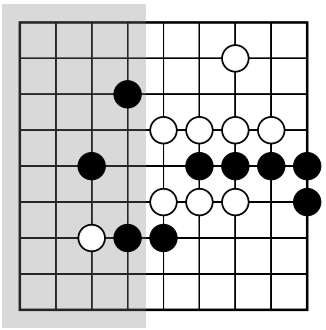
Avoiding empty rows and columns. As in all connection games, even a single stone in the way of a prospective connection of the opponent forces the adversary to place many more stones for that connection. Therefore, it is generally a good idea to use the early game for distributing one's stones evenly across the board. That way, no column (for Black connections) or row (for White connections) is particularly cheap to claim at the outset.

Remembering the fact that the knight's jump is flexible regarding the diagonal prohibition, a transition from early to mid game might look like in the adjacent position.
Here, close fighting has just begun. White's stones are spread out evenly, using many knight's jumps. By contrast, Black has started to form a chain; note that the Black's larger chain is pointing horizontally despite Black's ultimate aim of a vertical connection.

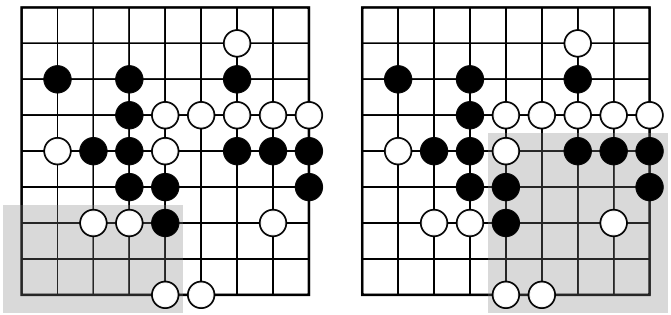


Of course, tactical considerations may once again trump equable spreading in the beginning. It can happen that close fighting sets in very early during a SLITHER match.

Local dominance. This is a feature common to many board games: once a particular area of the board comes into focus, it will be crucial which side has more stones in that region. Each subsequent turn may affect the local balance, immediately through placement and conditionally through movement of a close enough stone.

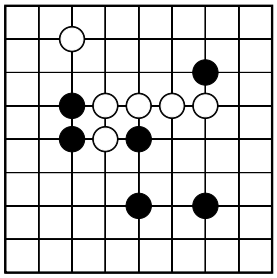


It is White's turn but this game is lost: the marked region is dominated by Black.

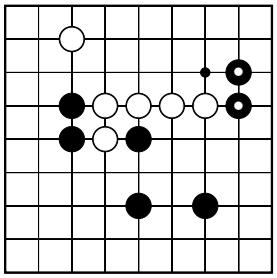


It is Black's turn: the lower left part is dominated by White, whereas the lower right part is dominated by Black. Therefore, Black will play towards the bottom right.

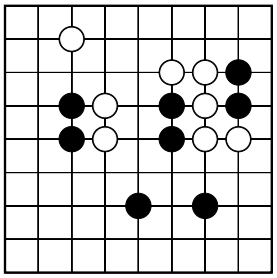
Leaning attacks. (*Open Door Trick*)
Stones can be bound not just through diagonal prohibition but also more indirectly: they may be an important piece for a prospective connection, or may constitute an essential block. In either case, forcing the opponent's stones to overload on duties can be key to success.



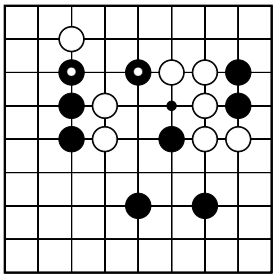
Black to play. The white wall is perfect and without cracks.



Black threatens to connect the top right to the bottom.

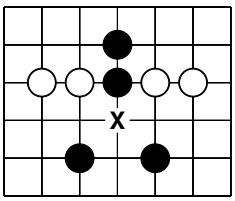


Three turns later: Black has lost the local fight.

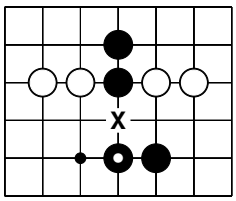


But now Black can fight on the left; White's wall has a crack.

Gaining tempo. SLITHER turns consist of one or two actions: movement and placement. Occasionally, a player can set up a threat with a single action in such a way that the opponent has to spend both actions on defence. That way, the player was able to use the other other action freely, and gained a tempo. The next diagrams are a schematic illustration of this concept:



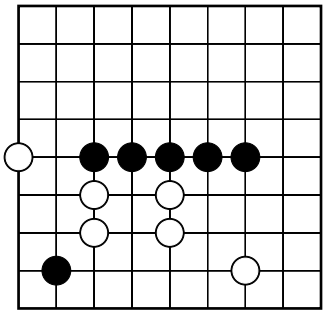
Consider this local position. Black's single movement action threatens a vertical connection in the next turn, and White can only defend by spending both actions near *X*. Thus Black gets a free placement anywhere on the board.



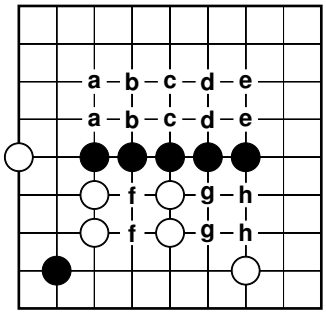
Building a perpendicular wall. (*The Reverse Way*)
As mentioned before, one form of flexible blocking is playing stones across the direction needed for a winning connection, i.e. horizontally for Black, and vertically for White.

The same principle can be employed on a strategic level, by attempting to build a straight, central line along the opponent's connection direction. The basic idea is that movement off the

wall together with proper placement can create pairs of stones around the spine. This concept is familiar from many connection games, such as HEX, but may be even more important in SLITHER due to movement. The following diagram from an actual game illustrates the thrust:



Black's central perpendicular wall of five.

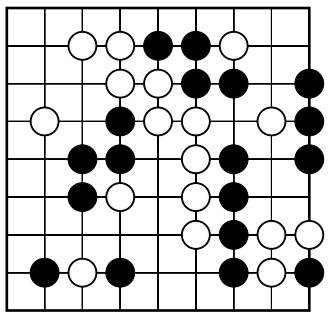


In one turn, Black can get two stones on any two points with same label, e.g. a,a.

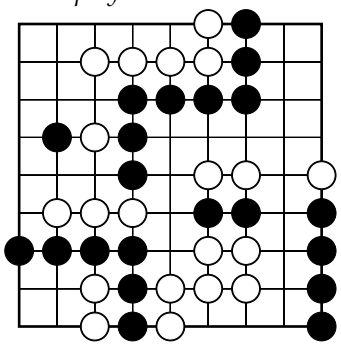
If in this position Black manages to cover two such pairs, one above and one below the line, e.g. *f,f* and *d,d*, then that will be a solid connection in Black's connection direction, of length five.

Other heuristics. Sometimes, players don't expect a turn where movement and placement are far apart. This can be something of a blind spot.
A concept familiar from other connection games: *defence builds offence*. In other words, when unsure about where to reinforce one's own connection, it might be best to hamper the opponent's position instead.

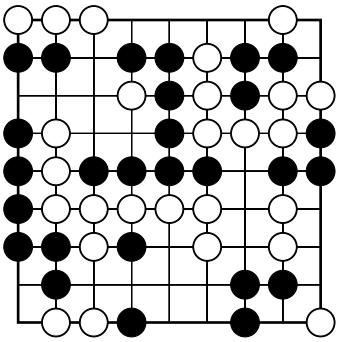
Three full-board problems: *White to play and win!*



Problem 7.



Problem 8.



Problem 9.

Other board sizes

SLITHER scales very well. Once past the beginner stage, players might try the 13×13 board, although size 9×9 will last a long while. I would reckon that the large GO board (19×19) is too big for all but the most dedicated SLITHER enthusiasts. However, some players have spoken out for 15×15 boards.

Literature

[A] Édourard Bonnet, Florian Jamain, Abdallah Saffine: *Draws, Zugzwangs, and PSPACE-Completeness in the Slither Connection Game*, In Proceedings of the 14th International Conference Advances in Computer Games (ACG 2015).

Solutions to the problems

Problem 1. ***e4-f3/f2***. Next **e2-f1/g1, f2-e1/e2** or **g2-f1/e1, h3-g2/g1**.
Problem 2. ***i1***. White's placement **h1** is forced, possibly with the move **i5-h4**. Black then wins with **g2-h3/i3**.
Problem 3. ***b3-c2/g2***. (Problem by Ralf Gering.)
1... **b2-c1/g1 2**. **c3-d2/f2, c1-d1/f1 3**. **d2-d1/e2, h4-g3/h3 4**. **g2-f3/f4**.
1... **h4-g3/h3 2**. **g2-f3/f4, b2-c1/f1 3**. **c2-d1/e3, c1-c2/e1 4**. **e3-d2/d3, f1-e1/e3 5**. **f3-f4/e4**.
2... **b2-b3/f1 3**. **c2-d2/e2, c3-c2/e1 4**. **g4-f5/d1, c2-c3/e2 5**. **f2-e3/d3**.
Problem 4. **g4-f3/d2, f4-e3/d1** followed by **f3-e2/e1**.
Problem 5. **h3-g2/d2, g3-f2/d1 2**. **h4-g3/e2, f2-f1/e1 3**. **g3-f2/f1**.
Problem 6. Does this work?
Problem 7. White **f5-g6/h8** wins. If ... **h7 2**. **W i3-h4/g5** and if **i5 2**. **g8-h7/i8**.
Problem 8. White **b4-c5/h5** wins.
Black's **b6-a5/a4** is countered by **d8-c7/b8**.
If Black connects in the centre with **d5-e4/e3**, White covers **c5-d5/e5**. This is why White should not play **c6-b5/h5** in the position. If Black does not play in the centre, White can connect with **f3-e4/e5**, using the square shape at the bottom. If White omits the placement at **h5**, Black's **g4-h4/h5** will establish a connection on the right.
Problem 9. White **d7-c6/a1** wins.

Temporary placeholder art only!