Spatial Chess: Complete Rules and Specifications

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Abstract

This paper presents the formal rules and structural design of "Spatial Chess," a three-dimensional extension of the classical game played on an $8 \times 8 \times 8$ grid. The author provides a detailed specification of the physical board consisting of 512 cubic fields and 64 transparent levels. While the movement logic is partially based on the FIDE Istanbul 2000 standards, it is significantly expanded to account for 3D vectors, including the introduction of the "Lion" (8-direction corner-to-corner piece) and the 24-direction Knight. This model serves not only as a complex strategy game but also as a specialized tool for developing 3D spatial orientation and cognitive skills essential for pilots, astronauts, and engineers.

Note on Priority: This document is an authorized English translation of the original Russian publication dated February 25, 2011. The original source is available at: `https://kosmos-x.net.ru/publ/14-1-0-189`

Figure 1: Physical working model of the Spatial Chess board.

1 Game Space Design

The playing space is a three-dimensional cubic grid divided into 512 cubic fields (8×8×8). Coordinates are defined as:

- **Horizontal:** A, B, C, D, E, F, G, H

- **Vertical:** 1, 2, 3, 4, 5, 6, 7, 8

- **Depth:** I, J, K, L, M, N, O, P

Fields are alternately colored black and white. The cube contains 64 transparent shelves, each holding 8 fields. At the start of the game, pieces are arranged on the shelves in a predefined complex order.

Move Execution Procedure

1. With one hand, partially pull out the shelf containing the piece to be moved.

2. With the other hand, pick up the desired piece.

3. Push the shelf back into place.

4. Pull out the shelf containing the destination field.

5. Place the piece on that field.

6. Push the shelf back.

2 Pieces and Initial Setup

Each player controls 116 pieces:

Piece	White	Black
King	1	1
Queen	3	3
Rook	12	12
Bishop	12	12
Knight	12	12
Lion	12	12
Pawn	64	64
Total	**116**	**116**

Abstract

The author's description of the board game "Spatial Chess" clearly outlines the structure of the playing space, which consists of wooden sticks arranged into a three-dimensional grid ($8 \times 8 \times 8$) and transparent plexiglass shelves. The fields are alternately colored black and white. Moves are made by pulling out the shelves. The sequence and rules for making moves are partially adapted from the rules of chess adopted at the 71st FIDE Congress in Istanbul (November 2000).

3 Initial Setup

Each player controls 116 pieces. The initial arrangement is shown in the table below:

Piece	White (Level 1)	Black (Level 8)
King	E1m	E8m
Queens	D1l, E1l, D1m	D8l, E8l, D8m
Rooks	A1i, C1i, E1i, H1i, A1k, H1k, A1m, H1m, A1p, C1p, E1p, H1p	A8i, C8i, E8i, H8i, A8k, H8k, A8m, H8m, A8p, C8p, E8p, H8p
Bishops	C1j, F1j, B1k, E1k, G1k, C1m, F1m, B1n, E1n, G1n, C1o, F1o	C8j, F8j, B8k, G8k, E8k, C8m, F8m, B8n, E8n, G8n, C8o, F8o
Knights	F1i, B1j, E1j, G1j, B1m, G1m, A1n, H1n, B1o, E1o, G1o, F1p	F8i, B8j, E8j, G8j, B8m, G8m, A8n, H8n, B8o, E8o, G8o, F8p
Lions	B1i, D1i, G1i, A1j, H1j, A1l, H1l, A1o, H1o, B1p, D1p, G1p	B8i, D8i, G8i, A8j, H8j, A8l, H8l, A8o, H8o, B8p, D8p, G8p
Pawns	All fields of level 2 (64)	All fields of level 7 (64)

Definitions

- **Levels:** I, J, K, L, M, N, O, P

- **Rows:** Frontal, Horizontal, Vertical

- **Diagonal:** A straight row of fields of the same color touching each other at corners.

Figure 2: Initial setup: Positioning of the White pieces (Level 1).
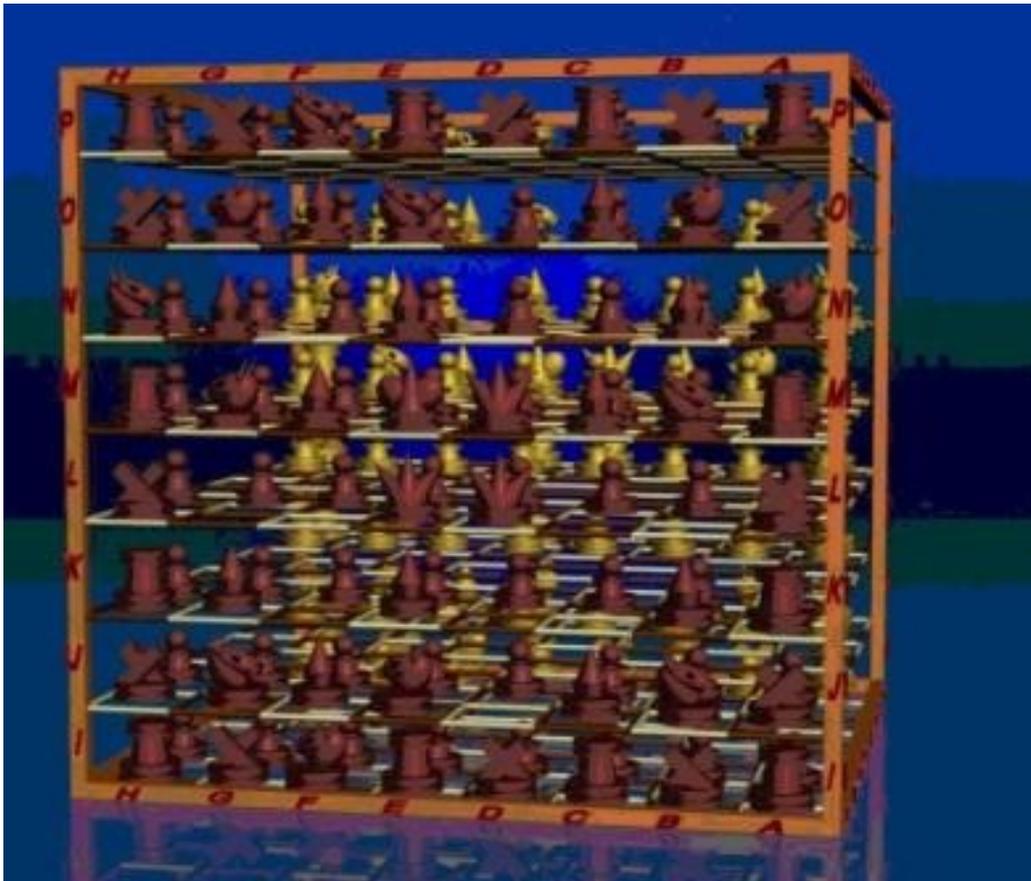
Figure 3: Initial setup: Positioning of the Black pieces (Level 8).

4 Rules of Movement

4.1 Rule 1: General Movement and Capture

It is not allowed to move a piece to a square occupied by a piece of the same color. If a piece moves to a square occupied by an opponent's piece, the latter is captured and removed from the board as part of the same move. A piece is said to attack an opponent's piece if it could capture it on that square.

4.2 Rule 2: Bishop

The bishop moves along all diagonals intersecting its position:

- Forward-down, Backward-up
- Forward-up, Backward-down
- Left-up, Right-down
- Left-down, Right-up
- Forward-left, Backward-right

- Forward-right, Backward-left

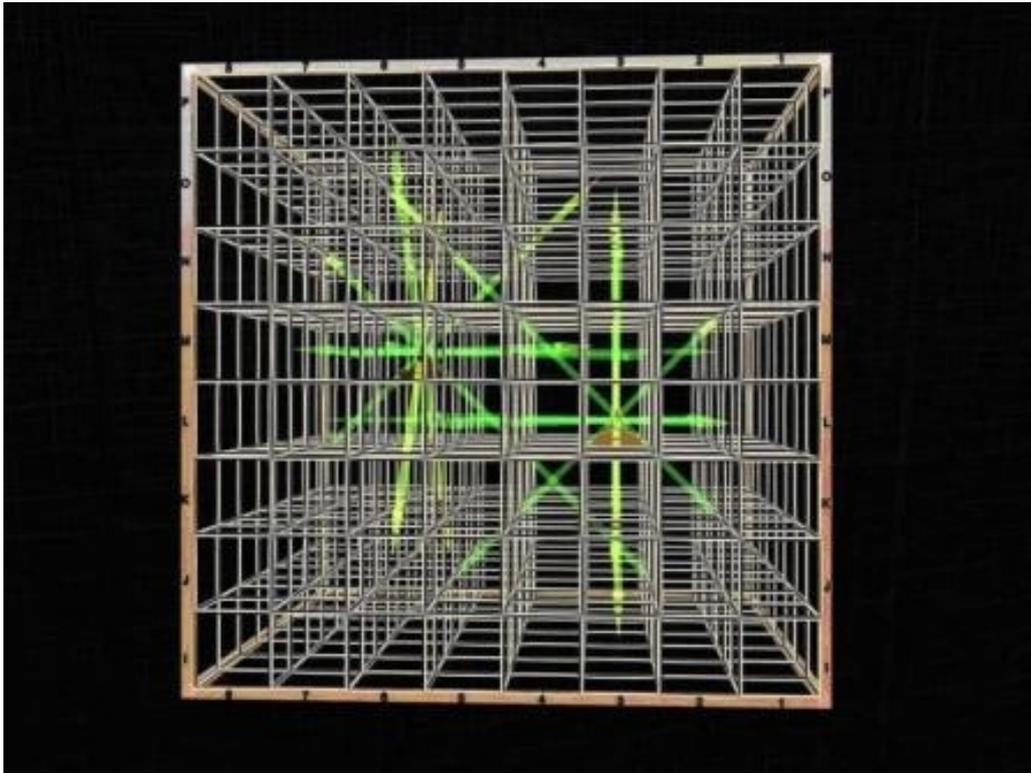*[Diagram placeholder: Bishop movement in 3D space]*

Figure 4: Movement of the Bishop in 3D space

4.3   Rule 3: Rook

The rook moves along all verticals, horizontals, and frontals intersecting its position:

- Left, Right
- Up, Down
- Forward, Backward

[Diagram placeholder: Rook movement in 3D space]

4.4   Rule 4: Queen

The queen moves to any square along the vertical, horizontal, frontal, or diagonal lines on which it stands.

[Diagram placeholder: Queen movement in 3D space]

4.5   Rule 5: Obstruction

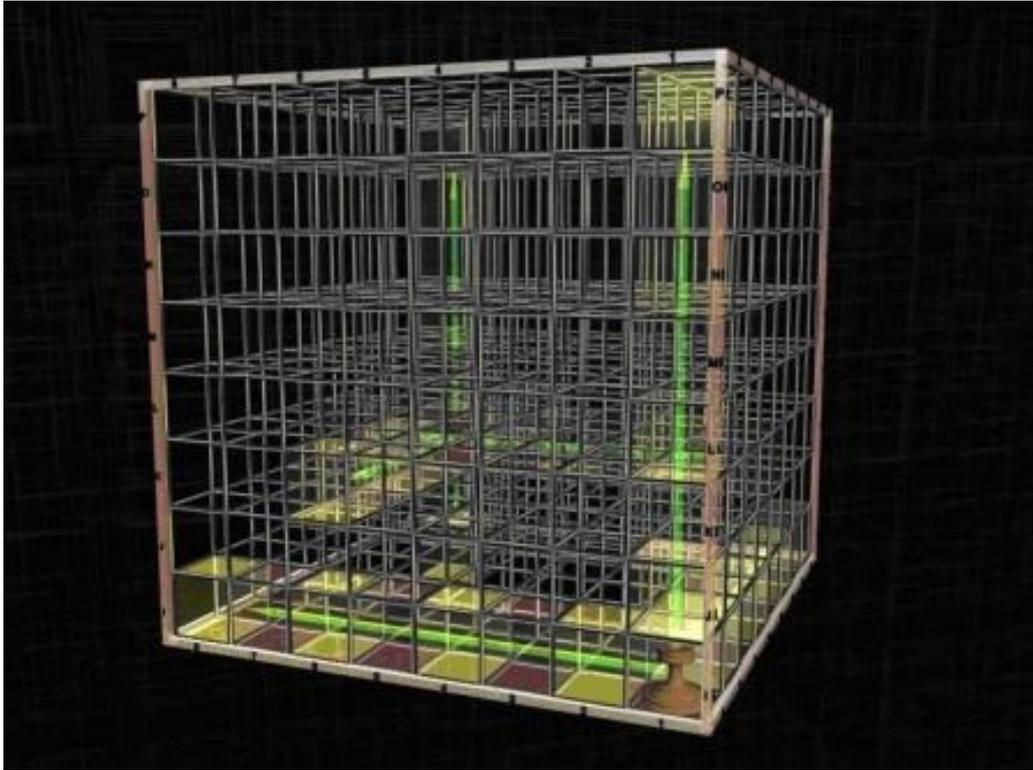When moving, the bishop, rook, or queen cannot pass through any piece standing in its path.
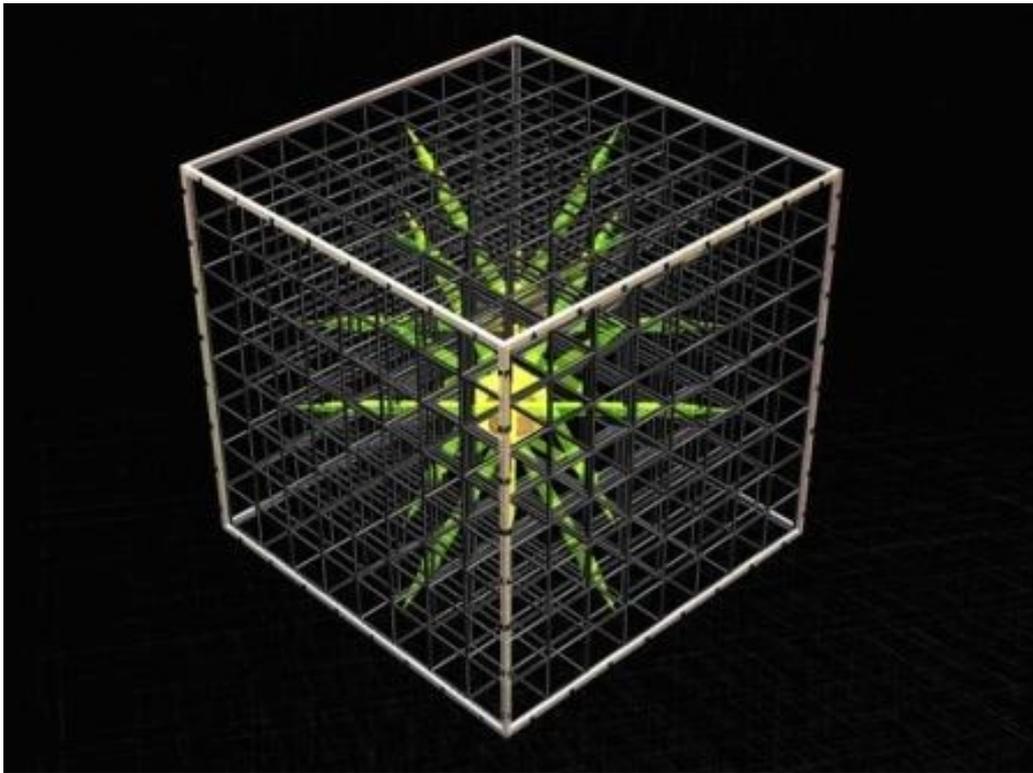
Figure 5: Movement of the Rook in 3D space

Figure 6: Movement of the Queen in 3D space

4.6   Rule 6: Knight

The knight moves to one of the squares closest to its position but not on the same horizontal, vertical, frontal, or diagonal line, located on one of the three intersecting planes. The knight

has up to 24 possible destination squares.
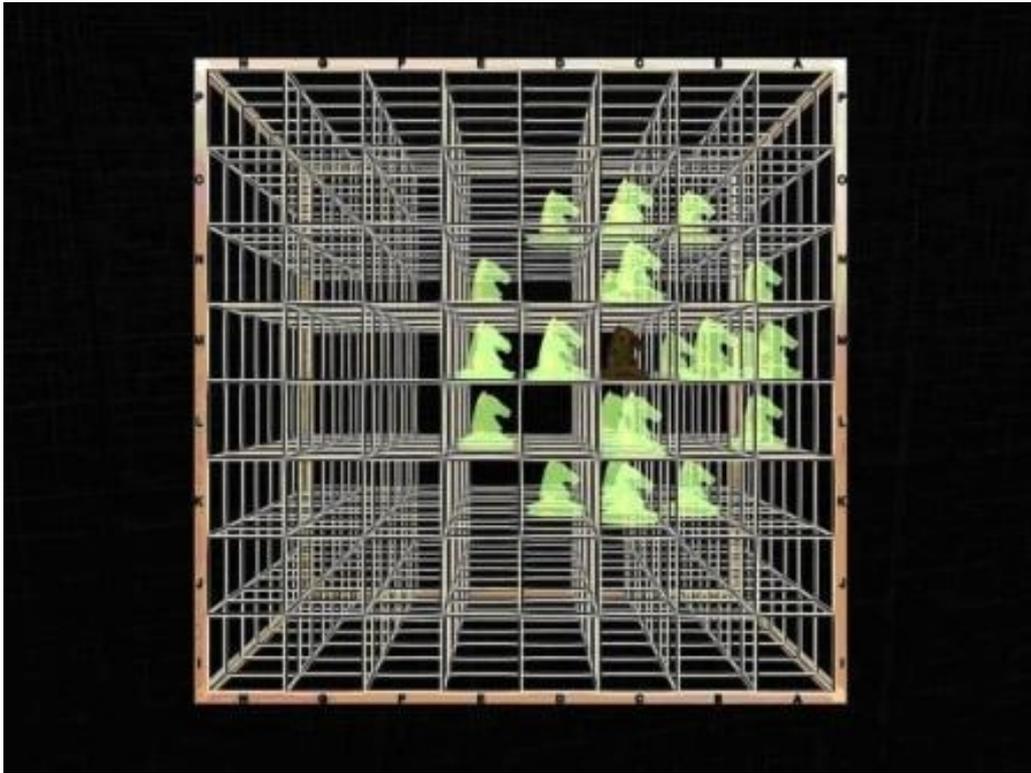
[Diagram placeholder: Knight movement in 3D space]

Figure 7: Movement of the Knight in 3D space

4.7 Rule 7: Lion

The lion moves to one of the squares closest to its position but not on the same horizontal, vertical, frontal, or diagonal line, and not on the same plane (corner-to-corner movement). The lion has exactly 8 possible destination squares.

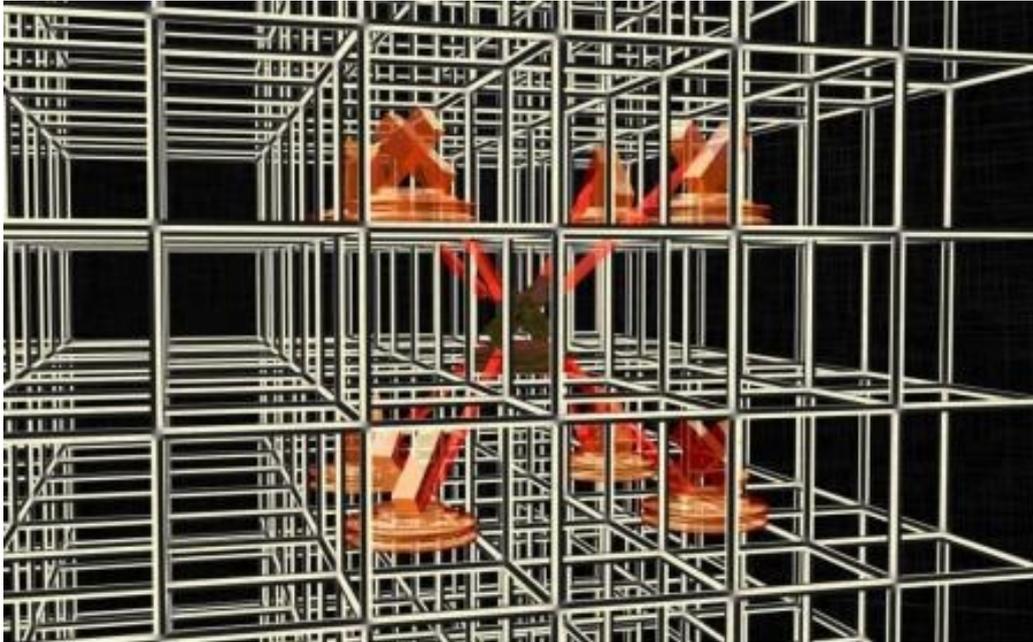*[Diagram placeholder: Lion movement in 3D space]*

Figure 8: Movement of the Lion in 3D space

4.8   Rule 8: Pawn

a) The pawn may move forward to an empty square directly in front of it on the same vertical.

b) On its first move, the pawn may also advance two squares along the same vertical, provided both squares are empty.

c) The pawn may capture an opponent's piece located diagonally in front of it on an adjacent frontal plane.

d) **En passant:** A pawn attacking a square crossed by an opponent's pawn that advanced two squares from its initial position in one move may capture that pawn as if it had moved only one square. This capture must be made immediately on the next turn.

e) **Promotion:** Upon reaching the farthest rank from its starting position, a pawn must be exchanged (as part of the same move) for a queen, rook, bishop, or knight of the same color. The choice is not restricted to previously captured pieces.

4.9   Rule 9: King

4.9.1   9.1 Movement

a) The king moves to any adjacent square not attacked by an opponent's piece (except along vector diagonals).

b) **Castling:** A move of the king and one rook of the same color along the same rank, counted as a single king move:

  • The king moves two squares toward the rook.

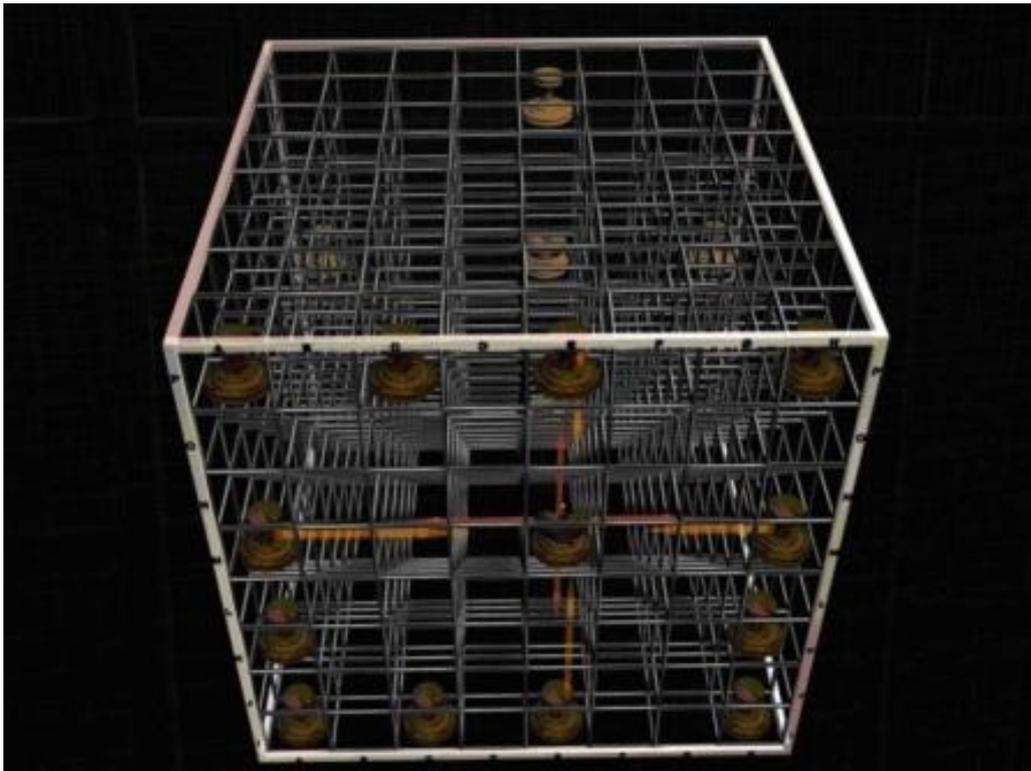- The rook moves to the square the king just crossed.

Figure 9: Movement of the King in 3D space

4.9.2   9.2 Castling Restrictions

Castling is impossible if:

a) The king has already moved.

b) The rook involved has already moved.

4.9.3   9.3 Temporary Castling Restrictions

Castling is temporarily impossible if:

a) The king's current square, the square it must cross, or its destination square is attacked by an opponent's piece.

b) There is any piece between the king and the rook.

4.10   Rule 10: Check

The king is in **check** if it is attacked by one or more opponent's pieces, even if those pieces cannot themselves move due to obstruction.

No piece may move in such a way that:

- It puts its own king into check, or

- Leaves its own king in check.

5   Additional Notes

- The game may be adjourned multiple times due to long thinking periods.

- The same hyperfield may be used to play **Checkers**, **Renju**, and possibly **Go**.

- All rules are based on the author's original Russian description dated February 25, 2011.

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