

# PROJECT RAND

**DOCUMENT**

**SOME WAR GAMES**

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Summary: These games are descendants of the one originally instigated by A. Mood, and are both played on his hexagonal-honeycomb-pattern board. The Ground War Game is presented by John Nash and the Air War Game by R. M. Thrall but both games embody concepts suggested by L. S. Shapley, O. Helmer, A. Mood, and others.

### SOME WAR GAMES

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#### GROUND WAR GAME

The game is played with incomplete information á la Kriegsspiel with an umpire. Or the appropriate modification can be played without the umpire. The board is a honeycomb pattern of hexagonal "squares," the same that was used in Mood's game. (See model of board on next page.)

The same sort of pieces, colored chips, are used. Cities are also used. And trucks, represented by a different color chip, are added to the game to provide differential mobility. Trucks are like cities, they can be captured.

At the beginning of the game, the umpire discretionally sets up the complete position of each side of the game, deciding upon the allotment of pieces and trucks and cities and upon their positions, subject only to those



restrictions on positions that apply during the course of the game. Both players or sides are informed of this initial position. Then play proceeds with the following cycle of stages:

- (1) Move (both move simultaneously; some attempts may be no's)
- (2) Receive information on adjacencies and reconnaissance
- (3) Aim fire
- (4) Remove dead, on umpire's instructions
- (5) Receive new men at cities - "production"

## SECTIONS OF THE RULES

### I. Moves

(a) "Men" can move to an adjacent square, but a pile of more than three men of the same player cannot be formed. All men of a pile move individually.

(b) A "truck" may carry one, two, or three men but its moves are restricted in a way that depends on the positions of the enemy pieces just before moving begins (this will be clear on the umpire's board, which will not be brought up to date until both sides have moved their trucks).

The move of a truck is three or fewer consecutive moves of a man, with the restriction that the move stops as soon as the truck reaches a square adjacent to one that was

occupied by an enemy man at the end of the last cycle. Men may disembark from a truck before the truck moves but not while it moves or after it has moved.

A truck must carry at least one man to move.

## II. Captures.

(a) A "city" is captured if at the end of a cycle the square of the city is occupied exclusively by men of the capturing player.

(b) The same rule governs capture of a truck. And it may be remarked that a truck can be moved only by its possessor, carries only his men and must carry at least one man to "drive" it.

## III. Production.

(a) Production of a man takes place on the square of a city. The color of the man produced is that of the possessor of the city, however.

(b) Production of a man does not take place if an enemy man is in the square of the city, or if three of the possessor's men are already there.

(c) Production occurs only after the city has been possessed for five consecutive cycles. This rule applies even at the beginning of the game.

#### IV. Information.

Aside from the information received via no's and the removal of the dead, each player is given certain specific information at the stage of the game [stage 2] devoted to this purpose.

(a) A player is told exactly what forces (men and trucks) (quantitatively) the enemy has on squares occupied by his men or adjacent to squares occupied by his men.

(b) He is also told the exact arrangement of those enemy trucks that are not more than two squares from some one of his men. (Quantitative.)

(c) And he is told which of the squares within two moves from the squares occupied by his men are occupied by enemy men. (Qualitative information.)

#### V. Firing Rules.

(a) Each man that

(1) Is adjacent to an enemy man, and

(2) Is not on a square also occupied by the enemy  
may aim his fire at any adjacent square.

(b) A man on a contested square (i.e., a square also occupied by an enemy man) automatically fires on the square he occupies.

#### VI. Death Rules.

The number of a player's men lost on a square receiving

fire from the enemy is determined by the number of men he has on that square and the number of enemy men firing on that square according to the table given below.

		Units of Fire Directed							
		1	2	3	4	5	6	-	-
Occupied By	1	0	1	1	1	1	1	-	-
	2	0	1	1	2	2	2	-	-
	3	0	1	1	2	2	3	-	-

Thus six units of fire power suffice to destroy any pile of men. And one unit is inadequate to destroy anything.

#### VII. Termination.

The game ends when the umpire discretionally awards victory to one of the players or calls the game a draw. He is required to award victory to a player if his opponent resigns or if he has both killed all enemy men and gained possession of all enemy cities.

#### VIII. Information Control Rules.

The umpire should avoid revealing any unnecessary information. The formally prescribed information on the nearby arrangement of enemy forces can be given openly because of its symmetrical property. The simplest way of giving it is by pointing and/or placing enemy colored men on a player's board.

The no's should be given quasi-secretly by the following procedure: The player indicates the three or fewer steps of his projected truck move. Then the umpire points to the position which the truck can actually get to and the player moves the truck to that position.

(a) Aiming, Deaths Free Information.

The firing patterns of the players are to be regarded as freely available information since potential patterns are computable from the available information and the significant aspect is only the ensuing deaths. The pattern of deaths is also free information because a player can compute the other player's losses due to his fire.

(b) Memory Ease Rule.

As a general principle, a player is to be given, on request, any information he once was given and has forgotten or did not properly note, insofar as the memories of the umpire and his opponent permit this. But this principle is not to be construed to justify his receiving any additional information.

IX. Allowable Modifications of the Game.

(a) Possible change in the production rate of cities, most likely in a downward direction.

(b) Change in the mobility of trucks.



(c) Inter-city jump moves (fast air transport), e.g., as a move of men [stage 1] a play may move a man from one of his productive cities to another such city if the two cities are adjacent (adjacency between cities being defined at the outset of the game by the umpire and perhaps dependent on non-occupation of intervening squares by enemy forces), this being so restricted that any city can receive but one man per cycle and send but one man per cycle.

This rule would have the effect of strengthening the defense and would promote the maintenance of a front line.

(d) In general, changes in the specific numbers involved in the rules, provided these do not completely change the nature of the game from what it was intended to be.

(e) The modification to dispense with an umpire.

(i) Alternate moves and fire, complete information. One playing board.

(ii) Simultaneous moves, two boards, information up to last cycle. Accomplished by intermittent use of intervening vertical board.

## AIR WAR GAME

This game is closely related in spirit to the Ground War Game discussed in the first section of this paper. The major difference is the replacement of trucks by aircraft. There is no air-to-air combat nor bombing in this game; the role of the aircraft is limited to troop transport.

This is a game with incomplete information. Each player has a board and there is a barrier which can be placed between the boards when secrecy is desired. The object of the game is to kill all of the pieces (men, chips). After the initial stage, the play goes in cycles, each of which consists of the following stages:

- (1) Simultaneous moves with barrier in place
- (2) Barrier removed to give complete information about opponent's position
- (3) Aim fire
- (4) Remove dead
- (5) Receive new men at cities

### Initial Stage.

(0.1) Each player determines the location of the opponent's cities subject to these conditions: there must be at least one city within four units of each boundary; no two cities are closer than six units to each other; each city is at

least two units from any boundary. In case of dispute, the barrier can be used at this stage or if an umpire is available he may assign locations for all six cities.

(0.2) The barrier is put in place and each player places his 30 initial chips at will in his own half of the board, provided that no field has more than 3 chips on it. Horizontal sections 12, 13, 14 are considered no-man's-land.

(0.3) The barrier is removed and each player fills in the positions of his opponent's chips on his own board.

(0.4) The first cycle now begins.

(1) Moves.

(1.1) Infantry chips. Each infantry chip is moved to an adjacent field. Two fields are said to be adjacent if they coincide or if they have a boundary in common.

(1.2) Airports. The field immediately behind each city is an airport. Airports may be contested or uncontested and may be possessed by either player (see below for airport activity rules).

(1.3) Airborne chips. If a player possesses an uncontested airport he may either designate a chip on that airport as airborne and then move it to any field not adjacent to an airport or city possessed by the enemy, or he may designate

two chips on that airport as airborne and then move it to any other airport in his possession.

(1.4) When a move is complete there cannot be more than three chips of one color on any field.

(2) Information Stage.

At this stage the barrier is removed and each player justifies his move to the other by playing his pieces on the opponent's board.

(3) Aim Fire.

(3.1) A field is said to be contested if it is occupied by chips belonging to both players. All chips on a contested field must direct fire to that same field.

(3.2) Any chip on an uncontested field may direct fire to any adjacent field.

(3.3) If either player requests secrecy the aiming of fire must be done in writing. (Ordinarily, this will be required for at most a few fields.)

(4) Death Rules.

Let  $x$  denote the number of units of fire power directed by one player at a field occupied by  $t$  enemy chips. Then  $\min(y(x), t)$  chips are killed where

$x$	1	2	3	4	5	6
$y(x)$	0	1	1	2	2	3

(5) Production.

Any uncontested city in the possession of its original owner has one new chip of his color placed on it provided that he has less than 3 chips on it after step (4).

(6) Possession and Activity Rules for Cities and Airports.

(6.1) A city is said to be contested if its field is contested.

(6.2) An airport is said to be contested if either its field is contested or the adjacent city is contested.

(6.3) A city is possessed by whichever player last had uncontested occupation of it. Any airport belongs to that player who possesses the adjacent city.