Search for the best strategy and coding of a game.

With the board game: *Clans*.

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I.   Introduction

A strategy game (or strategic game) is a game in which the players' uncoerced, and often autonomous, decision-making skills have a high significance in determining the outcome. Almost all strategy games require internal decision tree style thinking, and typically very high situational awareness.

The term "strategy" comes ultimately from Greek ($\sigma\tau\rho\alpha\tau\eta\gamma\iota\alpha$ or *strategia*) meaning generalship. It differs from "tactics" in that it refers to the general schemes of things, whereas "tactics" refers to organization and execution.

When it comes to strategy games, the question of intelligence is often invoked. Can playing strategy games make you more intelligent? This is a valid question, and one which is certainly worthy of consideration. Depending on whom you ask, responses will vary from affirmative to unsure, but there is consensus that strategy games train parts of our brain to plan ahead, understand complex interactions between components, and allow us to have a future orientation in our mindset. That being said, multiple studies have been conducted over the years, notably from Queen Mary University of London which found that various strategy-based games have the potential to improve and enhance cognitive function.

According to the study of 72 respondents, players who dabbled in 42 days – 56 days of gameplay comprising 40 hours of video games in total showed remarkable improvements in brain function. The comprehensive scientific study evaluated the intellectual effect of gaming on players. Two games were considered: The Sims, and StarCraft. The latter game is the strategy-based game and it showed significant enhancement in player performance in terms of cognitive flexibility, dexterity, processing accuracy and overall improvement.

II.   Background

An abstract strategy game is a strategy game in which the theme is not important to the experience of playing. Many of the world's classic board games, including chess, Go (also called "wei-chi" and "baduk"), checkers and draughts, xiangqi (Chinese chess), shogi (Japanese version of Chinese chess), Reversi (marketed as "Othello"), Nine Men's Morris, and most mancala variants, fit into this category. Play is sometimes said to resemble a series of puzzles the players pose to each other. As J. Mark Thompson wrote in his article "Defining the Abstract":

There is an intimate relationship between such games and puzzles: every board position presents the player with the puzzle, What is the best move?, which in theory could be solved by logic alone. A good abstract game can therefore be thought of as a "family" of potentially interesting logic puzzles, and the play consists of each player posing such a puzzle to the other. Good players are the ones who find the most difficult puzzles to present to their opponents.

Many abstract strategy games also happen to be "combinatorial"; i.e., there is no hidden information, no non-deterministic elements (such as shuffled cards or dice rolls), no simultaneous or hidden movement or set up, and (usually) two players or teams take a finite number of alternating turns.

The board game *Clans* is an abstract strategy game and this game centers on the creation of villages.

III.   Motivation

We are two students really interested in artificial intelligence but we realized that with this game it was more fun and more simple with the time that we had to create a greedy algorithm that could be sure to win all the time against another random player.

It's also really interesting to work from a board game and not a video game.

IV.   Problem formulation

Our goal is to use code to reproduce two players playing the game, and to find the best strategy that will guaranty victory. We would also like to reproduce the board with code. Hence our problem formulation: *Search for the best strategy and coding of a game.*

V.   Rules of *Clans*
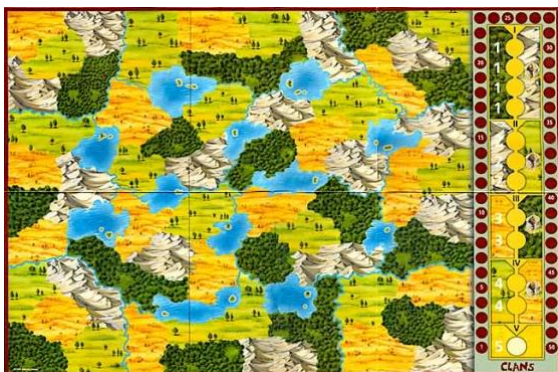
1.   Presentation of the board.

Fig 1. The board of the game.

You are given: one board, 60 huts, 5 cards, 4 score markers, 12 village foundation markers.

Principle of the game: there are always 5 clans at stake (regardless of the number of players), each clan is identified by a hut color: red, blue, green, yellow, and black (or white in some boxes). Each player tries to score points to his clan while trying to hide his identity from other players.

2. Movements.

In this game, there is only one type of movement: the player whose turn it is, moves the totality of the huts of a territory of his choice in an adjacent territory, provided that this territory is not empty. Thus, some territories are abandoned while villages are formed in others. However, there is one important restriction: a player can not move huts from a territory containing 7 huts or more. On the other hand, a player can bring huts to a territory containing 7 huts or more. In the rare case where two adjacent territories each contain 7 or more huts, a player may bring the smallest group into the largest box. If the two groups are strictly the same size, it is up to the player performing the action to choose which group he will move.

3. Villages.

When, following the movement of a player, huts (or a single hut) are completely surrounded by empty squares or by the edge of the board, a village is founded in this territory. When a village is founded, the player behind this move takes a village foundation marker to the left of the board (first markers of the first period, then those of the second, and so on from top to bottom) and place it in front of him (at the end of the game, he will score one point per marker of that type collected). The player then calculates the value of the village and the score markers are moved on the score track according to this calculation (see "6. Villages values").

4. Conflicts.

The different clans (represented by different colors) generally coexist peacefully. On the other hand, when the five colors of huts are represented during the foundation of a village, there is a conflict. In this case, when the village is founded (but not before the foundation), all lonely huts are eliminated.

5. Eras.

The game takes place during 5 eras. In each of the first four eras, one type of territory is particularly beneficial to the founding of villages, while another type of territory is extremely not beneficial, so much so that a village founded in such a territory is immediately destroyed. On the epoch table, the image on the left indicates the type of beneficial territory, and the right one on the not beneficial territory. During the 5th era, all types of territory are beneficial. When a village is founded in a beneficial territory, all the colors of huts present in the territory profit from a bonus of point. When a village is founded in a not beneficial territory, it is destroyed and no hut earns a point! The number of villages founded in each era corresponds to the number of foundation markers available for that time (4 for the first era, 3 for the second, and so on). An era ends as soon as all the foundation markers of that time have been taken. We then enter the next era.

When a player causes the simultaneous foundation of two villages as a result of a movement, he decides on the order in which those villages are founded. This is especially important when the double foundation is made between two eras. Similarly, if a player constructs two or more villages when the 12th and last village is created, he decides which of the two (or more) will be the 12th (which will earn bonus points to the huts in this village). All other villages founded at this time do not earn points.

6. Villages values.

When a village is founded, its base value is equal to the number of huts in that village (after resolution of any conflicts). There are then three possibilities:

- The village was founded in a type of territory that is neither beneficial nor not beneficial. In this case, the value of the village remains unchanged.
- The village was founded in a type of territory that is favorable for this time (land shown on the left of the table of times). In this case, the value of the village is increased by the figure of the time (indicated on the table). This bonus increases from time to time.
- The village was founded in a type of territory that is not favorable for this time (land shown on the right of the table of times). In this case, the village is destroyed, the huts are removed from the plateau and no point is earned.

7. End of the game.

The game ends immediately after the 12th village was founded. This village still earns 5 bonus points (in addition to its base value), regardless of the terrain on which it is based. It may also happen that no further movement is possible until the last village is founded. In this case the game ends immediately, without any other villages being founded.

At this moment, all the players reveal their secret colors. Color markers that do not that do not belong to any player are removed from the score track. Players advances their token on the score track based on the recovered foundation markers (1 point per foundation marker). The player with the most points is the winner.

8. Tactical ideas

- Founding villages is important because it brings bonus points, which can tip the scales in your favor at the end of the game.

- The more scattered your huts are, the more likely they are to be a part of village foundation. But it is important to be careful of the five-color territories, not to have a lonely hut destroyed.
- Do not let villages that contain your huts be based in non-beneficial territories.
- Watch for the table of eras: favorable and unfavorable territories change with it.

VI. The steps of our method

1. Basic functions we need.

We need a function that will memorize all the movements of the players. We also need a function that calculates the points of new village that just got created. Let's say we choose one region:

- To get the number of available neighbors, meaning that we need to know how many moves are possible from this region.
- To know which neighbors are available, meaning what moves are possible on the board from this region.
- To know if from this region we can create a village and, if so, how many.
- The list of the possible villages created when moving the huts of this region to another one.
- To evaluate the points earned by creating one village (or more) from moving the huts of this region.

2. Our strategy.

Our strategy is to test all the possibilities of movement and to choose the one that will give us the biggest difference of points with the other player.

- We create a function that enables us to do what we will call a random movement however it does not allow a movement from a source which has only 2 neighbors (because the other player would be able to create a village);
- We create another function which creates a village when it is possible, calculates the bigger difference of score between players and do not add one of my hut in a territory when it is not necessary;
- Using those two functions, we create our strategy.

3. Struggles.

While finding the best strategy, we realized that the game had a lot of constraints. We first started to think of doing an AI but we realized we were more comfortable doing a greedy algorithm.

VII. Conclusion

We didn't do everything we wanted to do with this project. For the project to be completed, we would still have to create a *class* that will allow us to battle two strategies against each other. Then, that code could be used in game app *Clans* on a computer, and we could then create a false player to play against the human.

That "strategy game" topic is vast, we could have done many things if given time. We created the code for the board but didn't make it to our first goal which was to battle two players.

VIII. References

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