Coalition Control Through Forced Betrayal

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Multiplayer games often suffer from the problem of non-strategic coalitions between players. This short note explores the use of an explicit revenge rule to counteract this problem, and finds it wanting, whereas an explicit betrayal rule appears to offer more potential for reducing coalition effects. These results are demonstrated on two hypothetical games.

1 Introduction

GAMES with more than two players can have inherent problems due to *non-strategic coalitions*[1] that might exist between players outside the context of the game, even pure strategy games with no hidden information and no chance elements. Three-player games tend to be especially prone to such problems, as there is not an even number of players to form stable teams.

Two common problems are the *kingmaker effect* [1], in which a player with no hope of winning is able to decide which opponent will be the eventual winner, and the *petty diplomacy* problem [2], in which two players tend to form an *alliance* at the expense of the third player or *victim*. Strategic coalitions can be beneficial for some games, as a balancing mechanism in which trailing players cooperate against the leader to prolong the contest, but non-strategic coalitions are generally detrimental to three-player games.

1.1 McCarthy's Revenge Rule

McCarthy's revenge rule is a metarule intended to reduce the kingmaker effect in what Straffin calls *three-person winner-take-all games* [3]. It can be expressed as:

> *If you are prevented from winning by a double-crosser, try to take the double-crosser with you.* [4, p. 159]

or:

> *If I find myself in a situation where I can no longer win but must choose which other player will win, I will look back to see who has put me in this undesirable situation and choose to make that player lose.* [3, p. 390]

This rule was proposed by computer scientist John McCarthy while playing So Long Sucker, 'a game of negotiation, alliances and backstabbing' [5], with its co-inventors including John Nash. This rule makes intuitive sense, and has an impressive heritage – McCarthy was one of the founders of artificial intelligence and Nash famously one of the founders of game theory and modern economics – so why does this rule not feature in the rule sets of more multiplayer games?

I believe that this is due to two main reasons. First, it was posed as a principle for rational players with no external agenda beyond the game, and this ideal situation rarely occurs in practice. Straffin's subsequent analysis even states that it does not take coalitions between players into account [3]. Second, it could simply be too difficult to enforce, as it may not always be clear *which* opponent is most to blame for an unfavourable position.

This paper proposes a simple development of this idea, to encode the revenge principle explicitly in the rules, so that players are *forced* to follow this principle regardless of their personal agendas, as a way of reducing the effect of non-strategic coalitions in multiplayer games.

2 Forced Revenge

There is an inherent logical problem with applying McCarthy's revenge rule directly to a rule set: *if two players have formed a non-strategic coalition, then neither will want to hurt the other the most.* This could actually make the coalition problem *worse*, as such a revenge rule would force the allies to act even more explicitly against the victim, who is fighting them both for dear life.

For example, consider the following hypothetical game called Revenge, invented for this exercise. The degree to which players hurt each other is indicated by the number of pieces captured. In order to test this game's robustness to coalition effects, let us assume that White and Black are *allies* who have prearranged a non-strategic coalition against the *victim* Red.[2]

[1] Coalitions between players that satisfy some personal agenda rather than being of strategic benefit to either.
[2] For black-and-white readers: White = light, Red = medium and Black = dark.

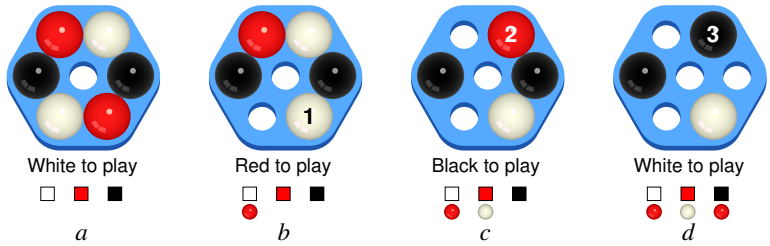

Figure 1. The first three moves in a game of Revenge. The victim (Red) has no protection.

Revenge is played on a hexagonal grid, with pieces in three colours, as shown in Figure 1 (*a*).

Three players (White, Red and Black), take turns moving one of their pieces to an adjacent cell, which can be empty or occupied by an enemy piece, which is captured and removed.

If the mover can capture a piece belonging to the opponent who has hurt them *more* than the other opponent (i.e. captured *more* of their pieces) then such a capture must be made. The last surviving player wins.

Figure 1 shows three moves in a game of Revenge. White's first move **1** captures a red piece, which is then listed in White's capture pile below the board (*b*). Red is then forced to capture a white piece due to the revenge rule, as White has captured more red pieces than Black; Red makes capturing move **2** (*c*). Black is free to make any move, and eliminates Red with move **3** (*d*).

The victim was eliminated by the allies almost immediately. The forced revenge rule offers little protection against coalitions.

3 Forced Betrayal

Now consider the following game, called Betrayal, in which the revenge rule is reversed, so that players are forced to hurt the opponent who has hurt them the *least*.[3]

Betrayal is played on a hexagonal grid, with pieces in three colours, as shown in Figure 2 (*a*).

Three players (White, Red and Black), take turns moving one of their pieces to an adjacent cell, which can be empty or occupied by an enemy piece, which is captured and removed.

If the mover can capture a piece belonging to the opponent who has hurt them *less* than the other opponent (i.e. captured *fewer* of their pieces) then that capture must be made. The last surviving player wins.

Figure 2 shows five moves in a game of Betrayal. White again starts by capturing a red piece with move **1** (*b*), but this time Red is forced to reply by capturing a black piece with move **2** (*c*), as Black has captured fewer red pieces than White. Black is then forced to attack their ally and capture a white piece with move **3** (*d*), as White has captured fewer black pieces than Red.

White then steps adjacent to the red piece with move **4** (*e*). This move is surprising, but is the best that White can do; any other move would give victory to Red (left as an exercise). Red eliminates White with move **5** (*f*), then the game is drawn, as both remaining players can elude capture indefinitely. The forced betrayal rule counteracted the White/Black coalition, by forcing one ally to turn against the other.

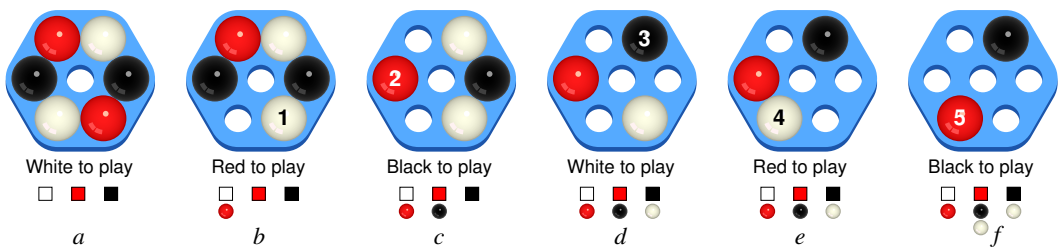

Figure 2. In a game of Betrayal, the victim (Red) can elude defeat if one ally is forced to attack the other.

[3]Including any opponent eliminated from the game.

4 Discussion

While these two example games may not be masterpieces of design, and are demonstrated on trivially small boards, they still serve to highlight the key point: *that forced revenge can exacerbate coalition effects, while forced betrayal can effectively counteract coalition effects*, by forcing allies to act against each other. This includes both non-strategic coalitions and the kingmaker problem, as the betrayal rule appears to remove from players some of the freedom to collude.

The notion of 'hurting' an opponent can be a slippery one to define. For example, in the Betrayal game shown in Figure 2, White superficially hurts Red by capturing a red piece on the first move, but this ultimately works out to Red's advantage; White could even be said to 'help' Red win with this move. However, rule sets need to be precisely defined, and the best we can do here is define 'hurt' to mean immediate material loss. It is in fact this discrepancy, between the immediate result imposed by the rules and the ultimate result of the game, that allows the betrayal mechanism to work.

Some games have explicit rules to deal with alliances. For example, the three-player version of Shogi called Sannin Shogi [6] involves explicit alliances between players, which may be stated *voluntarily* before the game or formed *automatically* during play, when two players attack the third. Alliances trigger a number of additional rules to come into play, in order to balance the game more fairly. The betrayal rule, on the other hand, is an attempt to implicitly dampen alliance effects seamlessly within the rules of normal play.

Forced betrayal does have some downsides. The need to explicitly define the degree to which each player has hurt each other player requires some bookkeeping and might be confusing for players; just look at the apparent complexity of the otherwise trivial games shown above. Also, being forced to betray otherwise benign opponents may be distasteful to some players. This mechanism, if used, would need to be carefully implemented and presented to players.

5 Conclusion

Forced betrayal is an under-utilised mechanism that offers a potential way to control coalition effects in multiplayer strategy games. The fact that it was so easy to invent an example, which shows its benefits so clearly, suggests that it might have practical application for more fully formed games in future.

Acknowledgements

Thanks to Don Kirkby for suggesting the Sannin Shogi example. This work was supported by a QUT Vice-Chancellor's Research Fellowship.

References

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