

THE GOOD, THE BAD AND THE MUGGY

Annex: Model specification

This document provides an overview of the theoretical model used in the paper and explains the assumptions used.

Step 1: Game structure

The game is played from a single character's point of view where they interact with everyone else on the island through a number of rounds. For simplicity we have assigned our character to be a woman, however the game works in exactly the same way if they are a man. Note that the main character in this game is part of the original 10 contestants and the game would look differently from the point of view of a later joiner.

There are 14 rounds in total in the game.¹

- **Round 1: first couples.** 5 men and 5 women randomly couple up with each other. This is immediately followed by one new female contestant entering the game who is able to steal (randomly) another person's partner.
- **Round 2: the first recoupling.** Two new men enter the game meaning there are now more men than women. The women get to decide who to couple up with. The man who is not picked is then dumped from the island.
- **Round 3: the first public vote.** One man and one woman are voted off the island.
- **Round 4: the second recoupling.** Two new women and one man enter the game. There are now more women than men which means that men get to choose who to couple up with. The woman not picked is dumped from the island.
- The **following 8 rounds** follow the same pattern: public vote, recoupling (women's choice), public vote, recoupling (men's choice) and the same again.
- **Rounds 13 and 14** are public votes where the audience vote for couples rather than for individuals. This is to mimic the show as closely as possible which has no recoupling rounds in the final week. Round 13 decides the finalists and round 14 decides the winners of the show.

The rounds contain the following features which are representative of the average week on the island.

- There is always an odd number of contestants on the island during a recoupling round. During public vote rounds there is always an even number of contestants.
- In the actual gameshow, sometimes the other Islanders get a say in the outcome of the public vote and sometimes they get to vote instead of the public.

¹ We note that the structure of the game was significantly different in Season 1 than it was in Seasons 2 and 3. We have therefore based the model on the latter two and used Season 1 data for guidance only.

We have assumed that the contestants follow the same voting pattern as the public and therefore treat all votes in the same way.

- In the lead up to elimination, it is usually revealed which Islanders are at the bottom three of the public vote. We have assumed that being in the bottom three is an indication of the unobservable outside factors that influence the public opinion of the contestants.

Step 2: Recoupling behaviour

In order to set up the game, first we define a baseline scenario. In this, each contestant in the game follows the same recoupling strategy, as described below.

We have observed that generally Islanders tend to stay with their current partner, unless something unexpected happens that makes them twist to a new partner, such as having an argument, losing interest or developing interest in another contestant. It also appears that the probability of this happening decreases the longer the couple has been together.

To mimic this, we have assumed that the probability of remaining in the couple is 50% at the start of the show and increases in increments of 5% each round. It is 100% for the final two rounds as there are no further opportunities for recoupling.

If the contestant has decided to twist, they will randomly choose who to couple up with. If this Islander is currently in another couple, they don't mind "stepping on toes" by stealing them.

Just like in the show, the recoupling takes place in order, so whoever goes first can recouple with anyone, the next person can recouple with one of the remaining contestants, and so on. In the model we have assumed that this order is random.

We then test four different strategies for the "main character" of the game to see how the length of staying on the island varies with each strategy, with all other players following the baseline character described above.

1. **Typical Islander.** This character follows the same strategy as all other players and therefore represents the base case.
2. **The Nice One.** This character never leaves their current partner. If their partner decides to twist, they will couple up with whoever is single at random.
3. **The Muggy One.** This character switches to a new partner every time it is their turn to make the recoupling decision. They choose their new partner at random even if this means stealing someone else's partner.
4. **Wily Economist.** The character chooses to couple up with the islander that will give them the highest score for the next public vote. The next section describes how this score is calculated.

Step 3: Voting behaviour

In the show, the public sometimes votes on individuals and sometimes on couples. In the model we have assumed that the votes are always cast for individuals. But each individual's probability of being voted off is linked to their partner's (explained below), therefore both people in the couple are likely to be voted off at the same time, just like in the programme.

We have observed that a number of factors affect the public vote.

- **Time spent on the island.** The public appear to form an attachment to the contestants that have been on the island for longer and are less likely to eliminate them.
- **Time spent with the current partner.** The public appear to form an attachment to couples as well as individuals and take the length of time spent together as an indicator of a strong relationship, making couples that have been together for longer less likely to be eliminated.
- **Number of twists.** The public tend to dislike contestants that switch partners often.
- **Number of steals.** The public tend to dislike Islanders who break up another couple in order to couple up with one of them.
- **Number of times in the bottom three of the public vote.** The contestants in the bottom three of a vote are likely to not be viewed favourably by the public due to various characteristics that are unobservable in the game. We have assumed that the public hold onto their impressions of the Islanders and are more likely to eliminate someone who was previously in the bottom three.
- Various **other events and personal characteristics** affect the voting behaviour of the public. These are all unobserved in the model and add an element of randomness.

We give each contestant a score based on the formula below². The score considered in the public vote is the sum of the scores of the two people in the couple. The public casts votes on men and women separately, so the two people dumped could be from the same couple and could be from different couples.

$$\text{Score} = 4 \times \text{Time on island} + 1 \times \text{Time together} - 2 \times \text{Number of twists} - 2 \times \text{Number of steals} - 4 \times \text{Number of times in bottom 3}$$

There is some probability of being voted off in each round for all islanders. The probability is based on the relative score of each Islander of the same sex. The Islanders with the lowest score are the most likely to be eliminated and the Islanders with the highest score are the least likely to be eliminated in each round.

In the last two rounds, the public vote on couples instead of individuals and therefore the probability of being eliminated depends on the couple's relative score to other couples.

² The formula is based on our observations of the relative importance of various factors in the public vote as well as fine-tuning to model outcomes that are close to the actual data collected.

Step 4: Game outcome

We set up the game as described above. The outcome of the game is the length of rounds that the main character remains on the island before being dumped. Each time the game is played results in a different outcome due to the various probabilistic elements in the rounds.

We run a simulation of the game 100,000 times for each of the four characters. The results provide a probability distribution of lasting to various stages in the game based on the chosen strategy. The number of rounds is then converted into the proportion of episodes following the typical number of events in a week throughout the duration of the show.