Journal of Interdisciplinary Science Topics

How Lucky is George Russell?

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03/03/2025

Abstract

In the 2024 Azerbaijan Grand Prix, Sergio Perez and Carlos Sainz crashed into one another when battling for P3, ultimately leading to George Russell miraculously going from P5 to P3 within the final lap. This paper explores the likelihood of this happening based on past driver's stats in the 2024 F1 season to see whether Russell came out lucky or whether this event was predictable.

Introduction

When interviewed before the 2024 Azerbaijan Grand Prix, George Russell joked that the ideal outcome for the race was "top 4 crashes and we win" [1]. However, during the race, Russell actually made the podium (Figure 1) from P5 due to Sergio Perez and Carlos Sainz crashing when battling for P3 in the penultimate lap of the race. With Russell only making the podium 17.4 % of races this season and only gaining a mean of 0.9 places each race, many would argue that gaining these 2 places on the final lap is extremely unlikely. This begs the question, was his previous statement just a joke with Russell coming out lucky, or were the chances of this event occurring so high that Russell could easily predict it?
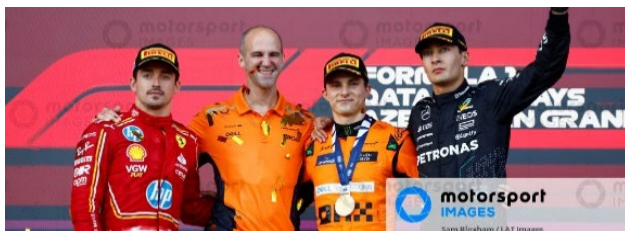

Figure 1 – Azerbaijan 2024 Podium showing (left to right)Charles Leclerc, Tom Stallard (Mclaren race engineer), Oscar Piastri, and George Russell [2].

This paper will use data from the 2024 F1 season to determine the likelihood of a crash occurring where Russell would go from P5 to P3 and the likelihood of the top four drivers crashing (Leclerc, Perez, Piastri, and Sainz) resulting in Russell winning.

Data Collection

Data was collected from the 2024 F1 season using the official FIA website and a fan-made website which tracked driver positions throughout each race [3-11]. Other seasons were excluded due to drivers being in different teams or not driving. Therefore, the 2024 season best represents the experience level of each driver, car competitiveness, regulations and the grid line-up at the time of the crash.

For Russell, data was collected regarding his starting position, penultimate position, and final positions in each race [3, 4] (Appendix A). For the other 4 drivers, data on whether or not they had crashed during grand prix, practice, qualifying, or sprints was collected [3-11]. This allowed the likelihood of each driver crashing to be calculated (Appendix B).

All crashes occurring over each race week were equally considered regardless of whether they occurred during grand prix, and whether they caused enough damage to end a race. This is because under the right conditions, even a small crash could result in race-ending damage. As well as this, although the chances of crashing during the different events are not the same, this difference is influenced by many hard-to-quantify factors with no available data (e.g., driver exhaustion, the distance between drivers in races with more or fewer drivers) so for the simplicity of the model, each crash will be considered to equally influence each drivers crash rate.

2 Drivers Crashing and Russell P5 → podium

The probability of any 2 drivers ahead of Russell crashing allowing him to go from P5 to the podium was calculated. This was calculated using the crash rate of each driver (the number of events they crashed in / the total number of events) and the probability of Russell being in P5 or above on the penultimate lap and finishing the race (Table 1).

Probability	Value (3 S.F)
$P(Leclerc\ crash)$	0.0168
$P(Perez\ crash)$	0.0252
$P(Piastri\ crash)$	0.0168
$P(Sainz\ crash)$	0.0504
$P(Russell\ in\ P5\ or\ above\ *)$	0.522
$P(Russell\ in\ P5\ exactly\ *)$	0.130
$P(Russell\ completes\ race)$	0.913

Table 1 – Each drivers crash rate, and Russell's race stats. (* on penultimate lap)

First, the probability of at least 2 drivers crashing was calculated (Appendix C) where the sum of the probability of only 1 driver crashing and the probability of no drivers crashing was subtracted from 1 (e.q. C1) (Table 2).

Probability of no drivers crashing - product of the probability of each driver not crashing (calculated by subtracting each driver's crash rate from 1) (e.q. C2).

Probability of only 1 driver crashing - product of the probability of only each driver crashing (eq. C4). For example, to calculate the probability of only Leclerc crashing, the product of the probability of the other drivers not crashing was subtracted from his crash rate (e.q. C3). This was then repeated for each driver (Table 2).

Probability	Value (3 S.F)
$P(only\ Leclerc\ crash)$	0.0152
$P(only\ Perez\ crash)$	0.0231
$P(only\ Piastri\ crash)$	0.0152
$P(only\ Sainz\ crash)$	0.0475
$P(only\ 1\ driver\ crashes)$	4.00×10^{-3}
$P(no\ crash)$	0.895

Table 2 – Probabilities calculated from driver's crash rates.

The probability of at least two drivers crashing and Russell going from P5 to the podium was then calculated from the product of the probability of at least 2 drivers crashing, the probability of Russell being in P5 or above on the penultimate lap and the probability of Russell finishing the lap (Appendix D) to give a final probability of 4.75×10^{-4}.

"Top 4 Crashes and We Win"

The chance of Russell's joke scenario, "top 4 crashes and we win", was also calculated. This was the product of the probability of all 4 drivers crashing (3.59×10^{-7}) calculated from the product of all 4 drivers crash rates, the probability of Russell being exactly P5 and the probability of Russell finishing the race (Appendix E). This scenario has a 4.26×10^{-8} chance of occurring and is $\sim 10^{-4}$ times more unlikely than the actual outcome of the race where only 2 drivers had to crash for Russell to make the podium. Therefore, it's fair to assume that Russell was not using probability to predict the outcome of the race and was instead just making a joke.

Podium based on Skill

The chances of Russell making the podium due to the drivers ahead of him crashing is 4.75×10^{-4} if at least 2 drivers crash and 4.26×10^{-8} if all 4 drivers ahead of him crash, making both scenarios extremely unlikely. However, in 2024 Russell finished on the podium in 17.4% of races, excluding the Azerbaijan Grand Prix. This result is mainly due to skill rather than just luck, for example, this season Russell outperformed his teammate Lewis Hamilton (7 times world champion [12]). Therefore, at the start of the race Russell is much more likely to have made the podium a race based on his own skill (17.4%) rather than due to the drivers ahead of him crashing (0.0475%).

However, Russell was in P5 in the penultimate lap lowering the chance of him finishing on the podium as he gains a mean of 0 (Appendix A) positions in his final lap, meaning the probability of him gaining at least 2 positions in this lap is basically impossible. Therefore, in this respect, it is incredibly unlikely that Russell would have come third without the crash.

Conclusion

Overall, the chances of Russell making the podium on a race where the 2 (4.75×10^{-4}) or 4 (4.26×10^{-8}) drivers ahead of him crash is extremely unlikely, and he is more likely to have made the podium based on his own talent. However, due to Russell being in P5 on the penultimate lap, the chance of him gaining at least two more places is practically 0, meaning he was unlikely to have made the podium if Sainz and Perez did not crash. Therefore, it is possible to conclude that Russell was incredibly lucky in the race resulting in him finishing in third place.

References

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Appendix A

George Russell Positions 2024

Race	Posisiton on penultimate lap	Ending Position	Starting Position	
Bahrain	5	5	3	
Saudi Arabia	6	6	7	
Australia	DNF (7 lap before penultimate)	DNF (17)	6	
Japan	8	7	9	
China	6	6	8	
Miami	8	8	7	
Emilia-Romagna	7	7	6	
Monaco	5	5	5	
Canada	3	3	1	
Spain	4	4	4	
Austria	1	1	3	
Great Britain	DNF (4 lap 33/52)	DNF (19)	1	
Hungary	8	8	17	
Belgium	1	1	6	Disqualified
Netherlands	7	7	4	
Italy	7	7	3	
Azerbaijan	5	3	5	***
Singapore	4	4	4	
United States	6	6	20	
Mexico	5	5	5	
Brazil	4	4	2	
Las Vegas	1	1	1	
Qatar	4	4	1	
Abu Dhabi	4	5	6	
	Average Penultimate Position*	Average Finish*	Average Starting Position	
	4.952380952	4.952380952	5.608695652	
	* averages not including DNF but including disqualified		*** Azerbaijain Grand Prix not counted	

Probability of finishing 3rd or above	0.173913
Probability of being in 5th on penultimate lap	0.130435
Probability of being in 5th or above on penultimate lap	0.521739

Probabilty of finsishing	0.913043

Positions Gained (Start to Finish)	Positions Gained (Penultimate to Finish)
-2	0
1	0
DNF	DNF
2	1
2	0
-1	0
-1	0
0	0
-2	0
0	0
2	0
DNF	DNF
9	0
5	0
-3	0
-4	0
2	2
0	0
14	0
0	0
-2	0
0	0
-3	0
1	-1
Average	Average
0.857142857	0

Data collected from 2024 Formula 1 season showing George Russell's starting, penultimate and finishing positions, the chance of him placing P3 or above, the chance of him being P5 on the penultimate lap, the probability of him finishing and the average positions gained from start to finish and penultimate to finish.

Appendix B

Crashes of Leclerc, Perez, Piastri, and Sainz				
Race	Leclerc	Perez	Piastri	Sainz
Bahrain	Finished	Finished	Finished	Finished
Saudi Arabia	Finished	Finished	Finished	Finished
Australia	Finished	Finished	Finished	Finished
Japan	Finished	Finished	Finished	Finished
China	Finished	Finished	Finished	Qualifying
Miami	Finished	Finished	Finished	Finished
Emilia-Romagna	Finished	Finished	Finished	Finished
Monaco	Finished	DNF	Finished	Finished
Canada	Retired	DNF	Finished	DNF
Spain	Finished	Finished	Finished	Finished
Austria	Finished	Finished	Finished	Finished
Great Britain	Finished	Finished	Finished	Finished
Hungary	Practice	Qualifying	Finished	Finished
Belgium	Finished	Finished	Finished	Finished
Netherlands	Finished	Finished	Finished	Finished
Italy	Finished	Finished	Finished	Finished
Azerbaijan	Practice	DNF	Finished	DNF
Singapore	Finished	Finished	Finished	Qualifying
United States	Finished	Finished	Finished	Finished
Mexico	Finished	Finished	Finished	Finished
Brazil	Finished	Finished	Finished	DNF and Qualifying
Las Vegas	Finished	Finished	Finished	Finished
Qatar	Finished	Retired	Finished	Finished
Abu Dhabi	Finished	Finished	2 Minor Crashes	DNF
Average*	0.016807	0.02521	0.0168	0.050420168
* average not inlcuding Azerbaijan GP Crash				
*** Azerbaijain Grand Prix not counted				

(Azerbaijan row marked ***)

The chances of each driver ahead of Russell crashing, with crashes shown in pink text, with non-grand prix crashes specified, calculated based on 120 different events.

Appendix C - Probability of at least two drivers crashing

Data from Supplementary table 3 was used to calculate the probability of at least two crashes occurring:
$$P(at\ least\ 2\ crash) = 1 - \big(P(only\ 1\ driver\ crashes) + P(no\ crash)\big) \hspace{2cm} (e.q.C1)$$

Probability	Value (3 S.F)
$P(leclerc\ crash)$	0.0168
$P(Perez\ crash)$	0.0252
$P(Piastri\ crash)$	0.0168
$P(Sainz\ crash)$	0.0504

Supplementary Table 3. Probability of each drive ahead of Russell crashing

Where the probability of none of the drivers crashing:
$$P(no\ crash) = \big(1 - P(leclerc\ crash)\big) \cdot \big(1 - P(Perez\ crash)\big) \cdot \big(1 - P(Piastri\ crash)\big) \cdot \big(1 - P(Sainz\ crash)\big)$$
$$(e.q.C2)$$
$$P(no\ crash) = (1 - 0.0168) \cdot (1 - 0.0252) \cdot (1 - 0.0168) \cdot (1 - 0.0504)$$
$$\boldsymbol{P(no\ crash) = 0.895}$$

And the probability of only one of the drivers crashing:
$$P(only\ 1\ driver\ crashes)$$
$$= P(only\ Leclerc\ crash) \cdot P(only\ Perez\ crash) \cdot P(only\ Piastri\ crash) \cdot P(only\ Sainz\ crash)$$
$$(e.q.C3)$$

Where the probability of only each driver crashing:
$$P(only\ driver\ 1\ crashes\ ) = P(driver\ 1\ crash) \cdot \big(1 - P(driver\ 2\ crash)\big) \cdot \big(1 - P(driver\ 3\ crash)\big)$$
$$\cdot \big(1 - P(driver\ 4\ crash)\big)$$
$$(e.q.C4)$$

$$P(only\ Leclerc) = P(Leclerc\ crash) \cdot \big(1 - P(Perez\ crash)\big) \cdot \big(1 - P(Piastri\ crash)\big) \cdot \big(1 - P(Sainz\ crash)\big)$$
$$P(only\ Leclerc) = 0.0168 \cdot (1 - 0.0252) \cdot (1 - 0.0168) \cdot (1 - 0.0504)$$
$$\boldsymbol{P(only\ Leclerc) = 0.0152}$$

$$P(only\ Perez) = P(Perez\ crash) \cdot \big(1 - P(Leclerc\ crash)\big) \cdot \big(1 - P(Piastri\ crash)\big) \cdot \big(1 - P(Sainz\ crash)\big)$$
$$P(only\ Perez) = 0.0252 \cdot (1 - 0.0168) \cdot (1 - 0.0168) \cdot (1 - 0.0504)$$
$$\boldsymbol{P(only\ Perez) = 0.0231}$$

$$P(only\ Piastri) = P(Piastri\ crash) \cdot \big(1 - P(Leclerc\ crash)\big) \cdot \big(1 - P(Perez\ crash)\big) \cdot \big(1 - P(Sainz\ crash)\big)$$
$$P(only\ Piastri) = 0.0168 \cdot (1 - 0.0168) \cdot (1 - 0.0252) \cdot (1 - 0.0504)$$
$$\boldsymbol{P(only\ Piastri) = 0.0152}$$

$$P(only\ Sainz) = P(Sainz\ crash) \cdot \big(1 - P(Leclerc\ crash)\big) \cdot \big(1 - P(Piastri\ crash)\big) \cdot \big(1 - P(Perez\ crash)\big)$$
$$P(only\ Sainz) = 0.0504 \cdot (1 - 0.0168) \cdot (1 - 0.0252) \cdot (1 - 0.0168)$$
$$\boldsymbol{P(only\ Sainz) = 0.0475}$$

The probability of only 1 driver crashing:
$$P(only\ 1\ driver\ crashes) = P(only\ Leclerc\ crash) \cdot P(only\ Perez\ crash) \cdot P(only\ Piastri\ crash)$$
$$\cdot P(only\ Sainz\ crash)$$
$$(e.q.C5)$$
$$P(only\ 1\ driver\ crashes) = 0.0152 \cdot 0.0231 \cdot 0.0152 \cdot 0.0475$$
$$\boldsymbol{P(only\ 1\ driver\ crashes) = 0.101}$$

The probability of at least 2 drivers crashing:
$$P(at\ least\ 2\ crash) = 1 - \big(P(only\ 1\ driver\ crashes) + P(no\ crash)\big) \hspace{2cm} (e.q.C1)$$
$$P(at\ least\ 2\ crash) = 1 - (0.101 + 0.895)$$
$$\boldsymbol{P(at\ least\ 2\ crash) = 4 \times 10^{-3}}$$

Appendix D - Probability of two drivers ahead of George Russell crashing leading to him going from P5 to the podium

Supplementary Table 4 was used to calculate the probability of George Russell making podium due to 2 drivers ahead of him:

$$P(Podium\ due\ to\ crash) = P(at\ least\ 2\ crash) \cdot P(Russell\ in\ P5\ or\ above)$$
$$\cdot\ P(Russell\ completes\ race) \qquad (e.q.D1)$$
$$P(Podium\ due\ to\ crash) = 4 \times 10^{-3} \cdot 0.522 \cdot 0.913$$
$$\boldsymbol{P(Podium\ due\ to\ crash) = 4.75 \times 10^{-4}}$$

Probability	Value (3 S.F)
P(Russell in P5 or above) (On penultimate lap)	0.522
P(Russell in P5 exactly) (On penultimate lap)	0.130
$P(Russell\ completes\ race)$	0.913

Supplementary Table 4. Probabilities based on George Russell's 2024 season performance.

Appendix E - Probability of the top 4 drivers crashing leading to George Russell going from P5 to P1

The probability of the top 4 drivers crashing leading to George Russell going from P5 to P1 was calculated using data from Supplementary Tables 3 and 4 and the equation:

$$P(4\ crash\ and\ we\ win) = P(4\ crash) \cdot P(Russell\ in\ P5\ exactly) \cdot P(Russell\ completes\ race)$$
$$(e.q.E1)$$

Where the probability of all four drivers ahead of Russell crashing:
$$P(4\ crash) = P(Leclerc\ crash) \cdot P(Perez\ crash) \cdot P(Piastri\ crash) \cdot P(Sainz\ crash) \qquad (e.q.E2)$$
$$P(4\ crash) = 0.0168 \cdot 0.0252 \cdot 0.0168 \cdot 0.0504$$
$$\boldsymbol{P(4\ crash) = 3.59 \times 10^{-7}}$$

And therefore, the probability of the top our crashing leading to George Russell winning,
$$P(4\ crash\ and\ we\ win) = P(4\ crash) \cdot P(Russell\ in\ P5) \cdot P(Russell\ completes\ race) \qquad (e.q.E1)$$
$$P(4\ crash\ and\ we\ win) = 3.59 \times 10^{-7} \cdot 0.130 \cdot 0.913$$
$$\boldsymbol{P(4\ crash\ and\ we\ win) = 4.26 \times 10^{-8}}$$