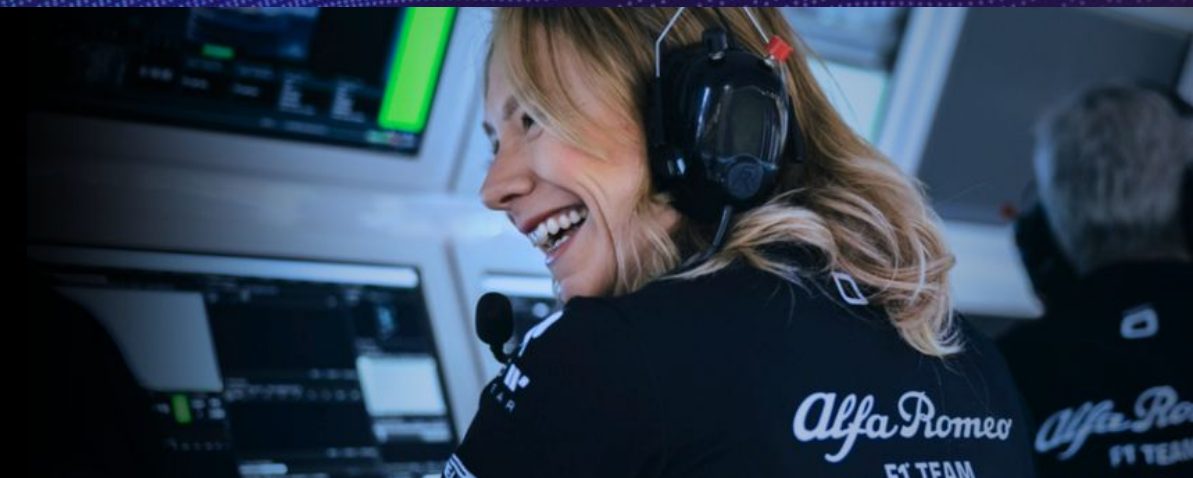


CHASING MARGINS UNDER PRESSURE:

What F1 teaches us about teamwork, judgement and performing when it matters most.

RUTH BUSCOMBE

May 13th



WHO AM I?



Simulation &
~~Strategy Engineer~~
Mathematical background driving performance modeling



Strategy Engineer
Race planning and real-time decision support



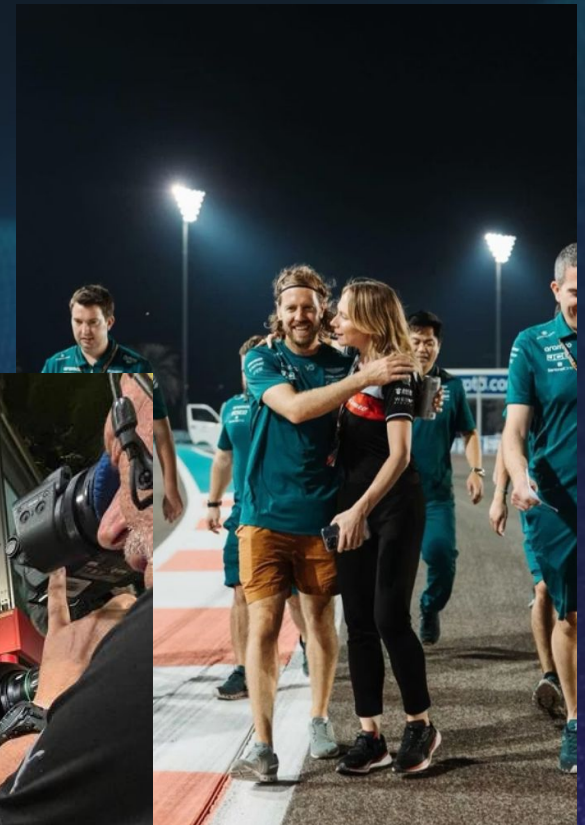
Head of Race Strategy
Leading strategic operations for multiple F1 teams



F1's First Strategist



Technical Advisor, Analyst, F1TV Presenter & F1 Movie
Consultant



START OF 2025 F1 SEASON POLE



POLL 1 OF 4

What is your primary reason for attending this webinar?

- To earn free CPE
- To explore new solutions
- To solve a a specific problem
- General interest/education
- Other

THE DATA RACE BEGINS



1950s & 1960s

Purely mechanical cars, stopwatches for timing



1970s

McLaren: 14 telemetry channels in IndyCar



1980s

First electronic cockpit displays appear



1990s

Live telemetry transforms race strategy

EVOLUTION OF RACING TECHNOLOGY

Early Technology

Basic readouts often unreliable, limited data capture

Computing

Revolution
Calculations central to race strategy and car development

Simulation Tools

McLaren pioneered simulator and Monte Carlo methods

Competitive

Advantage
Data insights provide temporary edge before adoption





F1 DATA TODAY: STAGGERING SCALE

1,000+

Data Points

GPS, weather, timing data collected per second

50 MB

Telemetry

Car telemetry data generated per second

60+

Radio Channels

Team communications monitored simultaneously

30+

Video Streams

Live feeds analyzed during each race

REAL-TIME DATA CHALLENGES

High Velocity

Data transmitted from cars moving at
200+ mph

Instant Analysis

Split-second decisions based on
massive data flows

Global Operations

Synchronized between track and
factory 10,000 miles away

Transmission Reliability

Consistent connections despite
challenging conditions



POLL 2 OF 4

Which of the following best describes how your firm currently makes investment decisions?

- We have a defined process and clear criteria for every investment
- We evaluate investments case by case but without a formal framework
- Most decisions are made reactively based on immediate needs
- We are in the process of building a more structured approach
- Other



MAXIMIZING DATA POTENTIAL



Expand Information Sources

Integrate diverse data streams for complete picture



Efficient Data Access

Seamless delivery to decision-makers



Extract Key Insights

Focus on performance-enhancing patterns



Build Decision Frameworks

Structured approach to strategic choices

STRATEGIC DECISION-MAKING

Marginal Gains Philosophy

Small improvements across every aspect add up to significant advantage

- Tire degradation modeling
- Weather prediction accuracy
- Pit stop optimization

AI Integration

Machine learning enhances traditional strategy tools

- Pattern recognition
- Prediction enhancements
- Decision support systems

Human Expertise

Technology augments but doesn't replace strategist judgment

- Emotional intelligence
- Adaptability
- Experience-based intuition

CLOSE TO THE WALL: AI INNOVATION



Frame Acquisition

Special cameras capture high-quality video footage



Car Detection

AI identifies vehicles using neural networks



Trajectory Estimation

Computer vision tracks position relative to walls



Measurement Output

Precise distance calculations visualized live

FRAME ACQUISITION TECHNOLOGY



Specialized Cameras

High-speed, high-resolution units capture millisecond detail



Strategic Placement

Mounted at critical track sections for optimal coverage



Image Processing

Initial filtering enhances visual quality for analysis



Instant Transmission

Dedicated networks enable real-time data flow



TRAJECTORY ESTIMATION PRECISION

Frame Sequence Analysis

Tracks car through multiple video frames

Position Calculation

Determines exact location relative to barriers

Orientation Detection

Measures car angle for proximity calculation

Closest Point Identification

Usually tire or wing edge nearest to wall

Margin of Error

Accuracy within millimeters at 200+ mph



ALGORITHM OUTPUT & VISUALISATION



Distance Calculation

Uses trigonometry to determine precise wall

proximity

- Millimeter-level precision

- Constant updates

- Synchronized timing data

PERFORMANCE APPLICATIONS

Speed Advantage

Closer proximity to walls means faster
lap times



Risk Assessment

Teams calculate risk vs. reward for wall
proximity



Competitive Edge

Milliseconds gained through optimal line
selection

Continuous Improvement

Drivers adjust approach based on data
feedback

Winning with Data-Driven Decisions in Fast Moving Environments

DATA

DATA

CENTRI

CITY

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DECISI

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ACTION

NS

Challenges Facing Teams at the 2024 Brazilian Grand Prix

The four critical areas teams needed to maximize at the 2024 Brazilian GP were:



Weather Prediction



Pit Stop Execution



Driver Performance



Strategic Decisions

THE 2024 BRAZILIAN GP

10 TEAMS. DIFFERENT OUTCOME.

Teams had **very** different results even though teams have access to the same pool of **Collaborative Open Shared Data**

Teams have a combination of **collaborative** tools & data PLUS their own **Proprietary** tools & data.

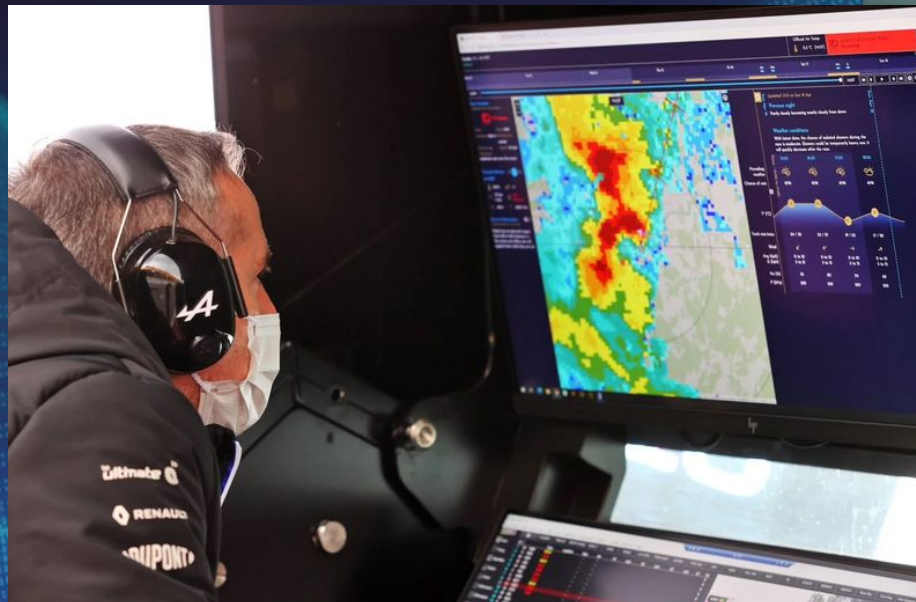
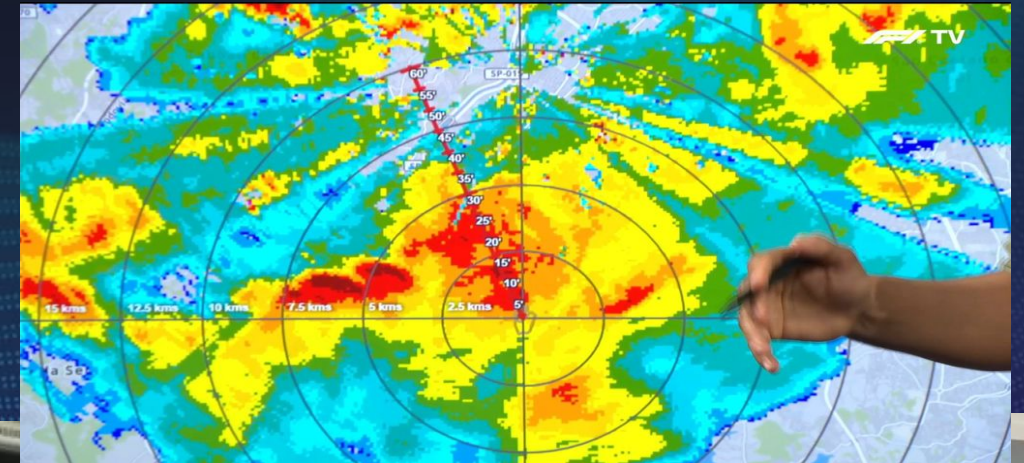
Let's deep dive how it all comes together and the Race was Won and Lost...

GRID			SAO PAULO GP		
1		NORRIS	2		RUSSELL
3		TSUNODA	4		OCONE
5		LAWSON	6		LECLERC
-			8		PIASTRI
9		ALONSO	10		STROLL
11		BOTTAS	12		PEREZ
13		GASLY	14		HAMILTON
15		BEARMAN	16		COLAPINTO
17		VERSTAPPEN	18		HULKENBERG
19		ZHOU	PL		SAINZ

THE 2024 BRAZILIAN GP WEATHER PREDICTION TOOLS

Collaborative: All teams use Meteo France

Proprietary: Teams can have their own Rain Spotters or in House Modelling tools



Proprietary: Teams can use the Tires however they choose



**FIA Formula 1
World Championship™**

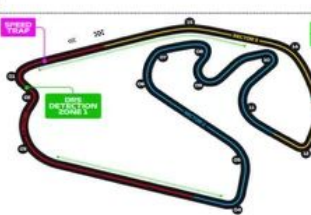


In agreement with the FIA and in accordance with Article 30.5 a) of the F1 Sporting Regulations, this document contains the prescriptions for the operation of tyres during the following event.

Document version 1 Issue A

Grand Prix of Brazil 01/11-03/11/2024 (24R21INT)

Circuit Layout



Compounds selection

Compound	FL	FR	RL	RR
C3	3F1	3F2	3F3	3F4
C4	4P1	4P2	4P3	4P4
C5	5S1	5S2	5S3	5S4
Intermediate	MW1	MW2	MW3	MW4
Wet	XW1	XW2	XW3	XW4

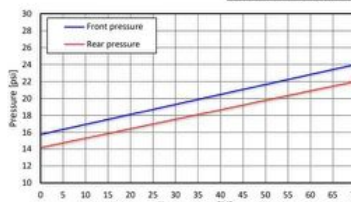
Mandatory race tyres
C3
C4

Prescriptions

Pressures & camber

	Minimum starting pressure			Expected stabilized running pressure	Camber limit
	Slicks	Intermediate	Wet		
Front	24.0 psi	24.5 psi	21.5 psi	≥26.0 psi	-3.00°
Rear	22.0 psi	23.5 psi	20.5 psi	≥24.0 psi	-1.75°

Cold Pressure Cooling Curve



$$P_{front} = (T - 70) \cdot 0.118 + P_{starf}$$

$$P_{rear} = (T - 70) \cdot 0.112 + P_{start}$$

P_{starf} : Minimum starting pressure on the front axle [psi]
 P_{start} : Minimum starting pressure on the rear axle [psi]
 T : Tyre temperature [°C]

Maximum heating times and temperatures (tread & sidewall)

Temperature	0	60	70 (°C)
Slicks	max. 2h		
Intermediate	max. 2h		
Wet	No blankets allowed		

• Temperatures refer to tyre tread and side wall temperatures, not blanket or controller set-point temperatures.
 • Tyres may only be heated prior to the session in which they are intended to be used.
 • The temperatures apply at all times during the event.

Tyre Notes

- Not permitted to switch tyres from their originally allocated position.
- Do not subject tyres to large deformation or heavy impact.
- Do not leave fitted tyres exposed at an air temperature lower than 10°C and/or any excessive UV emission.
- Revised prescriptions could be issued during the race weekend in accordance with TD003.
- Cut-off time for fitting tyres at an event on Sunday morning: 4 hours prior to the race start
- Heating time temperature limits apply to the actual tyre surface temperature measured with the IR gun as detailed in the TD003
- BLANKET HEATING TIME: for each temperature range to be counted from the moment the blanket control unit is set to reach its targeted temperature within its correspondent interval
- Cold cooling curve temperature limits apply to the tyre side wall temperature measured with the probe as detailed in TD003

General Notes

Teams are kindly reminded that the following will be subject to FIA checks during the event:

- Starting pressures
- Cold pressures (according to the cold pressure cooling curves)
- Re-heat pressures
- EOS Camber
- Maximum tyre temperatures and times in blankets
- Tyre swapping

THE 2024 BRAZILIAN GP

TELEMETRY SYSTEMS & ECU

Collaborative: All teams use a common ECU made by MESL (McLaren) and Telemetry Monitoring system ATLAS

Proprietary: Teams can Race and Performance Engineer the car anyway they like!



THE 2024 BRAZILIAN GP

TIMING & STRATEGY TOOLS

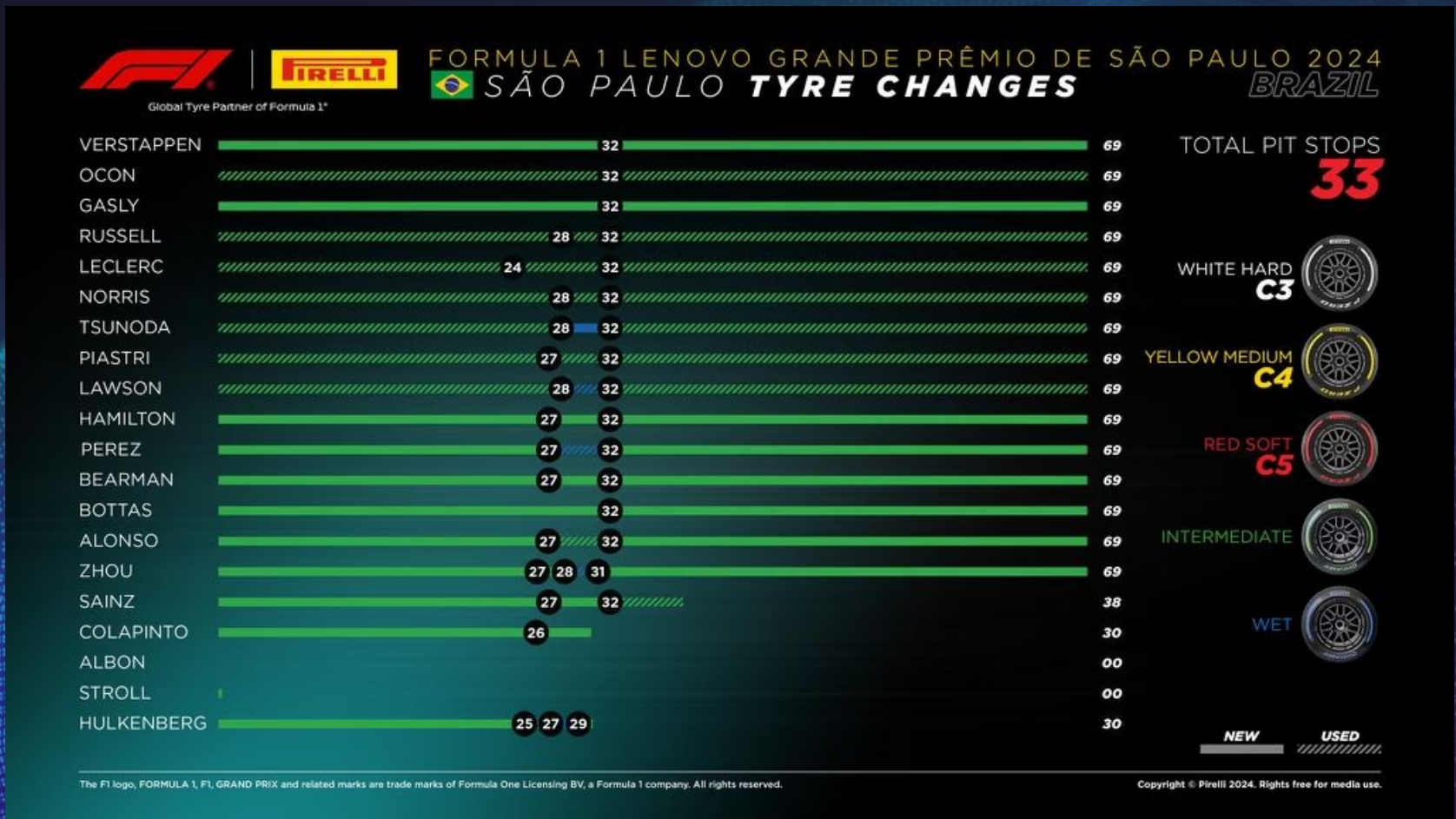
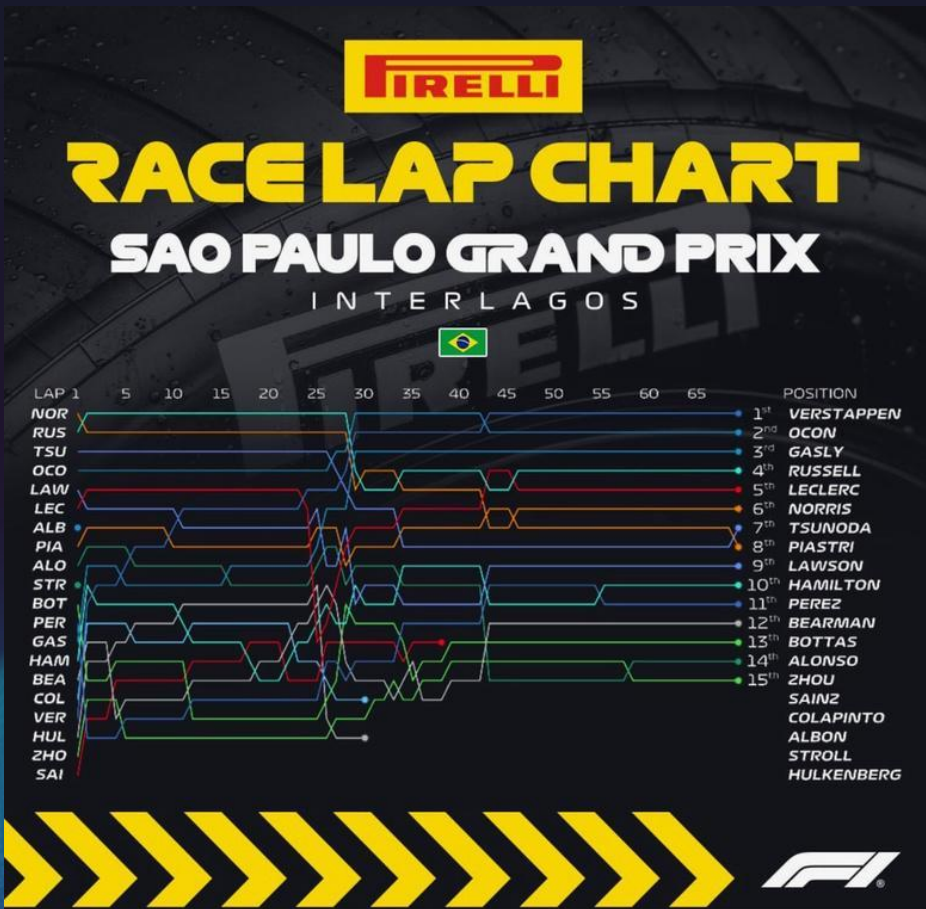
Collaborative: All teams use a common Timing and Strategy Software

Proprietary: Teams parameterize and build their own tools ...and of course make strategy decisions



THE 2024 BRAZILIAN GP

WINNERS vs. LOSERS



THE 2024 BRAZILIAN GP

THE LOSERS

Who? Charles Leclerc and Ferrari

Why? Boxed early and got stuck in Traffic



F1 RACE CLASSIFICATION		LAP 30 / 70	SÃO PAULO #BrazilGP
DRIVER	TEAM	GAP	WT STOPS
1 OCON	Alpine		0
2 VERSTAPPEN	Red Bull Racing	+7.546	0
3 GASLY	Alpine	+10.972	0
4 RUSSELL	Mercedes	+12.972	1
5 NORRIS	McLaren	+13.974	1
6 TSUNODA	RB	+22.367	1
7 LECLERC	Ferrari	+27.271	1
8 PASTOR	McLaren	+30.130	1
9 ALONSO	Aston Martin Aramco	+37.541	1
10 HAMILTON	Mercedes	+50.523	1
11 LAWSON	RB	+50.941	1
12 BOTTAS	Kick Sauber	+53.057	0
13 SAINZ	Ferrari	+56.630	1
14 PEREZ	Red Bull Racing	+57.022	1
15 BEARMAN	Haas	+58.511	1
16 COLAPINTO	Williams	+1:01.873	1
17 ZHOU	Kick Sauber	+1 LAP	2
18 HULKENBERG	Haas	+1 LAP	2
ALBON	Williams	OUT	0
STROLL	Aston Martin Aramco	OUT	0

POLL 3 OF 4

When it comes to strategic planning, which best describes your firm today?

- We plan proactively and have a clear strategy in place before busy season
- We have some planning in place but mostly adapt as challenges arise
- We tend to make decisions reactively under pressure
- We are actively working to improve our planning process
- Other

THE 2024 BRAZILIAN GP

THE LOSERS

- Who? Lando Norris and McLaren
- Who? George Russell and Mercedes
- Why? Boxed under the VSC before the Red Flag came out.

F1 RACE CLASSIFICATION				LAP 30 / 70	SÃO PAULO #BrazilGP
DRIVER	TEAM	TIME	PTS	STOPS	
1 OCON	Alpine		0		
2 VERSTAPPEN	Red Bull Racing	+7.546	0		
3 GASLY	Alpine	+10.972	0		
4 RUSSELL	Mercedes	+12.972	1		
5 NORRIS	McLaren	+13.974	1		
6 TSUNODA	RB	+22.367	1		
7 LECLERC	Ferrari	+27.271	1		
8 PIASTRI	McLaren	+30.156	1		
9 ALONSO	Aston Martin Aramco	+37.541	1		
10 HAMILTON	Mercedes	+50.523	1		
11 LAWSON	RB	+50.941	1		
12 BOTTAS	Kick Sauber	+53.057	0		
13 SAINZ	Ferrari	+56.630	1		
14 PEREZ	Red Bull Racing	+57.022	1		
15 BEARMAN	Haas	+58.511	1		
16 COLAPINTO	Williams	+1:01.873	1		
17 ZHOU	Kick Sauber	+1 LAP	2		
18 HULKENBERG	Haas	+1 LAP	2		
ALBON	Williams	OUT	0		
STROLL	Aston Martin Aramco	OUT	0		



Formula 1 @F1 · 1d

He started from pole and ended up P6

Lando Norris reflects on his ups and downs at Interlagos

#F1 #BrazilGP

0:42

THE 2024 BRAZILIAN GP

THE WINNERS

Who? Max Verstappen and Red Bull Racing

Why? Stayed out and changed tires for free under the Red Flag. ...and overtook everyone!

Only 5 of the 1121 GPs have been won from 17th or lower on the grid



THE 2024 BRAZILIAN GP

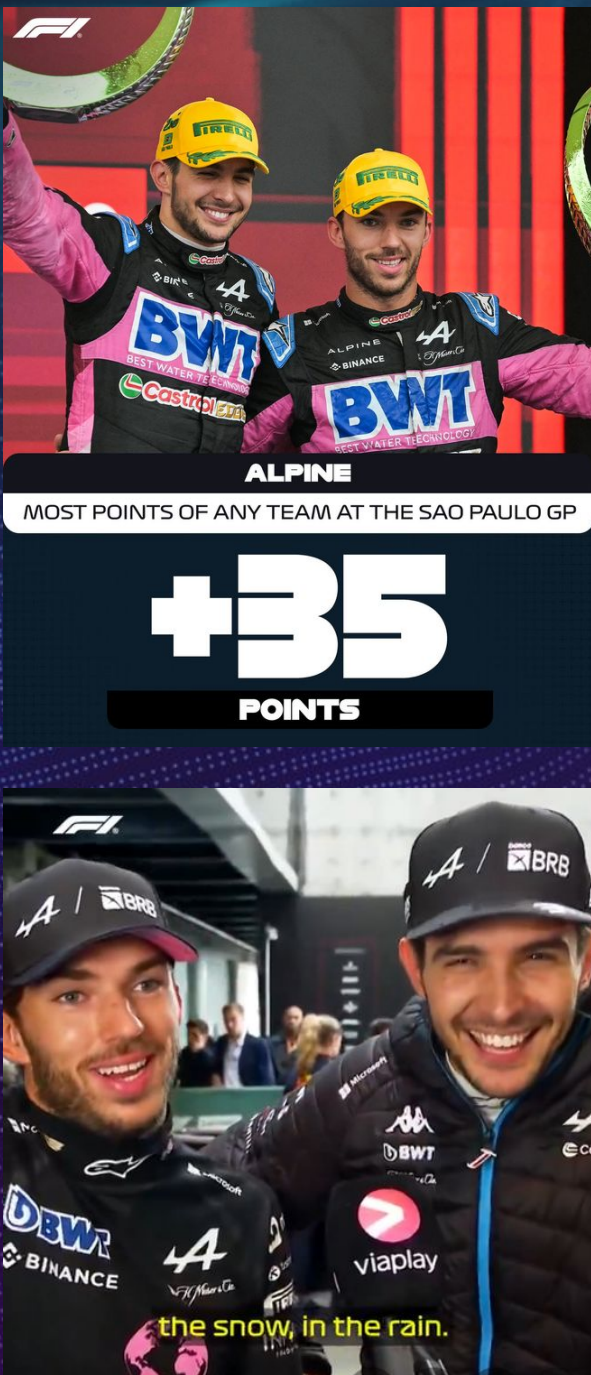
THE WINNERS

Who? Esteban Ocon and Alpine

Who? Pierre Gasly and Alpine

Why? Stayed out and changed tires for free under the Red Flag.

3 Championship positions and the first double podium since 2013!



What are you most excited to explore at Elevate 2026?

- Strategies to grow my firm's advisory services
- Tools and technology to drive efficiency
- Staffing and team building approaches
- Pricing and marketing strategies
- All of the above



THE BUSINESS OF WINNING IN FORMULA 1



Financial Impact

Each position worth millions in prize money and sponsorship



Team Structure

1,000+ personnel delivering marginal gains across disciplines



Partnership Value

Technology transfers between F1 and sponsors drive innovation



Global Brand Platform

500+ million fans worldwide following technological battleground

Winning with Data-Driven Decisions in Fast Moving Environments

The **CORE** of Formula 1 Success

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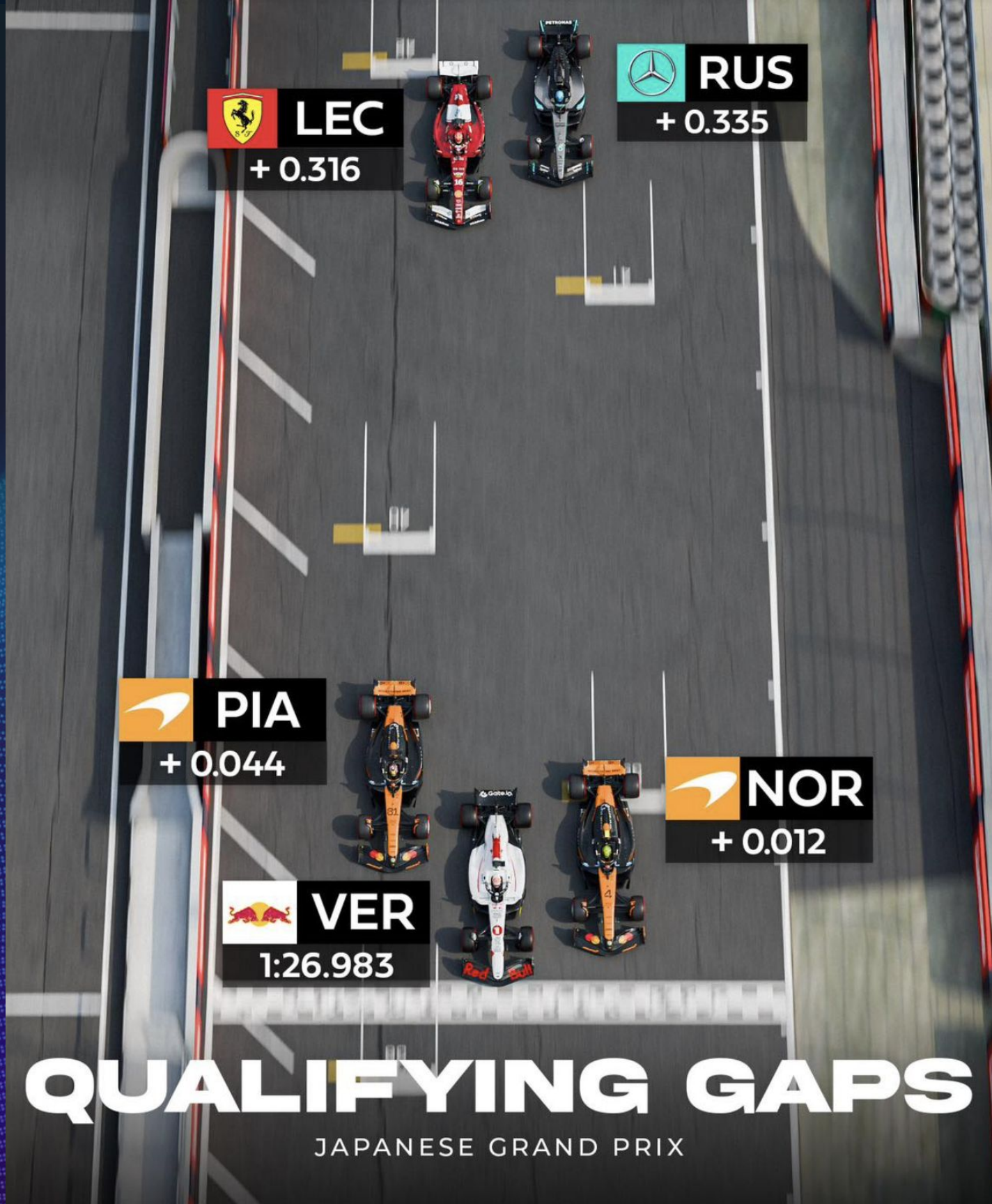
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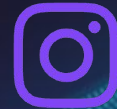
Thank you for Listening

Q&A Session



Contact

[/in/ruthbuscombe/](#)



Socials

[@RuthBuscombe](#)



Next Race

Canadian Grand Prix