Advanced Setup Matrix

This document is intended as a quick reference guide. It is not supposed to include detailed explanations. Nor is it supposed to be my soap box. Refer to the source material, if you want more detailed explanations of what's actually going on. Virtual racing is a fantastic hobby, and is certainly not for everyone. However, if you have the patience to stick with it, you will find it very satisfying.

I set this up to help me solve specific tuning problems with driving simulations. That is, sometimes I'll get in a car I don't know, or on a track with some extreme(ish)/odd situations/corners (Knutstorp), and I want a quick reference to see which adjustments I should be fiddling with.

This was originally a paraphrase of the setup guide in the back of the handbook from EA's F1 2002, but I have added sections from a few online sources, and given credit when I did.

For actual explanations of various bits, I highly recommend you read RacerAlex' Avanced F1 Setup Guide (http://watcher.drivingitalia.net/index.php?name=Downloads&d_op=viewdownloaddetails&lid=23)

NOTE: This was based on information from a variety of sources, and is supposed to be a general purpose tool, so not all items apply to all cars.

I certainly take responsibility for my work. If you find erroneous information, or think I should add something, email me: cbarnett[at]yahoo[dot]com?subject=Setup Matrix

Topic (and what it might affect)

1. Gearing (speed, and acceleration)
2. Brake Duct Size (engine cooling, and speed)
3. Engine Rev Limit (horsepower, reliability)
4. Engine Brake Mapping (fuel consumption, and snap oversteer)
5. Radiator Size (engine cooling, straight line speed)
6. Steering Lock (turning circle, and control)
7. Differential Lock (stability, [snap] oversteer, and understeer)
8. Wings (grip, tyre wear, top speed, oversteer, and understeer)
9. Anti-Roll Bars (grip, surface handling, corner exit, tyre wear, responsiveness, oversteer, and understeer)
10. Weight Distribution (oversteer, and understeer)
11. Brake Bias (stopping distance, braking stability, snap oversteer)
12. Camber (grip in corners)
13. Caster (turn-in, oversteer, understeer, corner stability)
14. Toe-in (turn-in, tyre wear, top speed, and stability)
15. Tyre Pressure (grip in corners, tyre wear, understeer, and oversteer)
16. Ride Height (bottoming out, understeer, and oversteer)
17. Packers and/or Bump Rubber (bottoming out, understeer, and oversteer)
18. Spring Rate (bumpy surfaces, grip, tyre wear, responsiveness, understeer, and oversteer)
19. Bump Damping (tyre wear, bumpy surfaces, grip, nervousness, understeer, and oversteer)
20. Rebound Damping (tyre wear, responsiveness, corner entry, and exit, understeer, and oversteer, chassis roll)
21. Simulating understeer, and oversteer with the brake, and/or throttle
22. Simulator Controls (Steering wheel, pedals, etc)
23. Links
24. Glossary

Section	Action	Effect on Balance	Other Effects
1	*Gearing*		
1.1	Lengthen Gears	None	Increase *potential* maximum speed; decrease acceleration.
1.2	Shorten Gears	None	Decrease *potential* maximum speed; increase acceleration
2	*Brake Duct Size*		
2.1	Increase	None	Increase engine cooling; decrease straight line speed.
2.2	Decrease	None	Decrease engine cooling; increase straight line speed.
3	*Engine Rev Limit*		
3.1	Increase	None	Increase horsepower; higher engine temperature; lower reliability
3.2	Decrease	None	Decrease horsepower; lower engine temperature; higher reliability.
4	*Engine Brake Mapping*		
4.1	Increase	Decrease oversteer under negative throttle	None
4.2	Decrease	Increase oversteer under negative throttle	Reduces fuel consumption; low numbers can exacurbate snap oversteer, if you suddenly lift in a corner.
4.a	*Engine Brake Mapping will affect how much the engine helps slow down the car - lower numbers result in MORE engine braking, which also uses less fuel. The downside is that the engine only slows down the driven wheels, which can cause a braking imbalance between high and low speed.* From the rFactor ReadMe		
5	*Radiator Size*		
5.1	Increase	None	Increase engine cooling; decrease straight line speed.
5.2	Decrease	None	Decrease engine cooling; increase straight line speed.
6	*Steering Lock*		
6.1	Increase	None	Decrease turning circle; coarser steering control
6.2	Decrease	None	Increase turning circle; finer steering control

Section	Action	Effect on Balance	Other Effects
7	**Differential Lock**		
7.1	Increase Power and Coast	Increase understeer in corners	None
7.2	Increase Power	Increase understeer under postive throttle	More stable off the line
7.3	Increase Coast	Increase understeer under negative throttle	More stable under hard braking
7.4	Decrease Power and Coast	Increase oversteer in corners	None
7.5	Decrease Power	Increase oversteer under postive throttle	Less stable off the line
7.6	Decrease Coast	Increase oversteer under negative throttle	Less stable under hard braking
7.7	Increase Pump (4WD)	?	Front wheels pull more than rear
7.a	***Preload*** *affects how quickly the transition between power and coast differential occurs. If you used a preload of '1' and slammed the throttle down you would get a very quick transition to whatever your power percentage age was, the reverse would happen with taking the throttle off. With a higher preload the above effect would be a lot more gradual.* *TKD in the RSC rFactor forum* *(http://forum.rscnet.org/showpost.php?p=2626021&postcount=24)* *People tend to use the words **"understeer" and "oversteer"** when describing the effect of the differential lock. In reality, oversteer is truly the only thing you are actually adjusting. It's only because a lack of oversteer naturally moves the car closer to an understeer condition that understeer is used as a descriptor at all.* *RacerAlex' Avanced F1 Setup Guide* *(http://watcher.drivingitalia.net/index.php?name=Downloads&d_op=viewdownloadd etails&lid=23)*		

Section	Action	Effect on Balance	Other Effects
8	***Wings***		
8.1	Increase Front	Increase oversteer in corners	Increase front grip in corners; increase front tyre wear; decrease straight line speed.
8.2	Increase Rear	Increase understeer in corners	Increase rear grip in corners; increase rear tyre wear; decrease straight line speed.
8.3	Increase Front and Rear	None	Increase grip in corners; decrease straight line speed.
8.4	Decrease Front	Increase understeer in corners	Decrease front grip in corners; decrease front tyre wear; increase straight line speed.
8.5	Decrease Rear	Increase oversteer in corners	Decrease rear grip in corners; decrease rear tyre wear; increase straight line speed.
8.6	Decrease Front and Rear	None	Decrease grip in corners; increase straight line speed.
9	***Anti-Roll Bars***		
9.1	Increase/Stiffen Front	Increase understeer in corners	Decrease grip on bumpy surfaces; increase front tyre wear; more *responsive* handling
9.2	Increase/Stiffen Rear	Increase oversteer in corners	Decrease grip exiting corners; decrease grip on bumpy surfaces; increase rear tyre wear; more *responsive* handling
9.3	Increase/Stiffen Front and Rear	None	Decrease grip exiting corners; decrease grip on bumpy surfaces; increase front, and rear tyre wear; more *responsive* handling
9.4	Decrease/Soften Front	Increase oversteer in corners	Increase grip on bumpy surfaces; decrease front tyre wear; less *responsive* handling
9.5	Decrease/Soften Rear	Increase understeer in corners	Increase grip exiting corners; increase grip on bumpy surfaces; decrease rear tyre wear; less *responsive* handling
9.6	Decrease/Soften Front and Rear	None	Car may bottom out more often; increase grip exiting corners; increase grip on bumpy surfaces; decrease front and rear tyre wear; less *responsive* handling

Section	Action	Effect on Balance	Other Effects
10	**Weight Distribution**		
10.1	Adjust to front	Increase oversteer	None
10.2	Adjust to rear	Increase understeer	None
11	**Brake Bias**		
11.1	Adjust to front	Increase understeer while braking	Front wheels can lock up, increase braking distance, reduce *snap* oversteer
11.2	Adjust to rear	Increase oversteer while braking	Rear wheels can lock up; increase braking distance; increase *snap* oversteer (swap ends)
11.3	Adjust to centre	Some oversteer while braking	Decrease braking distance; *may* cause snap oversteer, depending on front/rear weight distribution, wing, etc.
12	**Camber**		
12.1	Increase Front	None	Increase grip in corners... to a point
12.2	Increase Rear	None	Decrease grip in corners... to a point
12.3	Decrease Front	None	Decrease grip in corners... to a point
12.4	Decrease Rear	None	Increase grip in corners... to a point
13	**Caster**		
13.1	Increase	Decrease understeer	Decrease turning radius; Increase oversteer in fast corners.
13.2	Decrease	Increase understeer	Increase high speed corner stability.
14	**Toe In**		
14.1	Increase front (positive)	None	Improve turn-in; increase front tyre wear; decrease straight line speed
14.2	Increase rear (positive)	None	Improve stability; increase rear tyre wear; decrease straight line speed
14.3	Decrease front (negative)	None	Decrease turn-in; increase front tyre wear; decrease straight line speed
14.4	Decrease rear (negative)	None	Decrease stability; increase rear tyre wear; decrease straight line speed

Section	Action	Effect on Balance	Other Effects
15	**Tyre Pressure**		
15.1	Increase Front	Increase understeer	Decrease grip in corners; decrease front tyre wear
15.2	Increase Rear	Increase oversteer	Decrease grip in corners; decrease rear tyre wear
15.3	Increase Front and Rear	None	Decrease grip in corners; decrease front and rear tyre wear
15.4	Decrease Front	Increase oversteer	Increase grip in corners; increase front tyre wear
15.5	Decrease Rear	Increase understeer	Increase grip in corners; increase rear tyre wear
15.6	Decrease Front and Rear	None	Increase grip in corners; increase front and rear tyre wear
16	**Ride Height**		
16.1	Increase Front	Increase understeer in fast corners	Car may bottom out less often
16.2	Increase Rear	Increase oversteer in fast corners	Car may bottom out less often
16.3	Increase Front and Rear	None	None
16.4	Decrease Front	Increase oversteer in fast corners	Car may bottom out more often
16.5	Decrease Rear	Increase understeer in fast corners	Car may bottom out more often
16.6	Decrease Front and Rear	None	None

Section	Action	Effect on Balance	Other Effects
17	**Packers and/or Bump Rubber**		
17.1	Increase Front	Increase understeer	Allows front ride height to be reduced without bottoming out
17.2	Increase Rear	Increase oversteer	Allows rear ride height to be reduced without bottoming out
17.3	Increase Front and Rear	None	Allows ride height to be reduced without bottoming out
17.4	Decrease Front	Increase oversteer	Car may bottom out more often
17.5	Decrease Rear	Increase understeer	Car may bottom out more often
17.6	Decrease Front and Rear	None	Car may bottom out more often
18	**Spring Rate**		
18.1	Increase/Stiffen Front	Increase understeer	Decrease grip in corners; decrease grip on bumpy surfaces; increase front tyre wear; more *responsive* handling
18.2	Increase/Stiffen Rear	Increase oversteer	Decrease grip in corners; decrease grip on bumpy surfaces; increase rear tyre wear; more *responsive* handling
18.3	Increase/Stiffen Front and Rear	None	Decrease grip in corners; decrease grip on bumpy surfaces; increase front and rear tyre wear; more *responsive* handling
18.4	Decrease/Soften Front	Increase oversteer	Increase grip in corners; increase grip on bumpy surfaces; decrease front tyre wear; less *responsive* handling
18.5	Decrease/Soften Rear	Increase understeer	Increase grip in corners; increase grip on bumpy surfaces; decrease rear tyre wear; less *responsive* handling
18.6	Decrease/Soften Front and Rear	None	Increase grip in corners; increase grip on bumpy surfaces; decrease front and rear tyre wear; less *responsive* handling

Section	Action	Effect on Balance	Other Effects
19	**Bump Damping**		
19.1	Increase/Stiffen Front	Increase understeer in bumpy corners	Increase front tyre wear
19.2	Increase/Stiffen Rear	Increase oversteer in bumpy corners	Decrease grip on bumpy surfaces; increase rear tyre wear
19.3	Increase/Stiffen Front and Rear	None	Decrease grip on bumpy surfaces; increase front and rear tyre wear; nervous and unpredictable handling
19.4	Decrease/Soften Front	Increase oversteer in bumpy corners	Decrease front tyre wear
19.5	Decrease/Soften Rear	Increase understeer in bumpy corners	Increase grip on bumpy surfaces; decrease rear tyre wear
19.6	Decrease/Soften Front and Rear	None	Increase grip on bumpy surfaces; decrease front and rear tyre wear

Section	Action	Effect on Balance	Other Effects
20	**Rebound Damping**		
20.1	Increase/Stiffen Front	Increase understeer during corner exit, and entry	Increase front tyre wear
20.2	Increase/Stiffen Rear	Increase oversteer during corner exit, and entry	Increase rear tyre wear
20.3	Increase/Stiffen Front and Rear	None	More *responsive* handling
20.4	Decrease/Soften Front	Increase oversteer during corner exit, and entry	Decrease front tyre wear
20.5	Decrease/Soften Rear	Increase understeer during corner exit, and entry	Decrease rear tyre wear
20.6	Decrease/Soften Front and Rear	None	Less *responsive* handling
20.a	Slow damping affects the **weight transfer** of the car's sprung mass (**chassis pitch and roll**) on the springs; fast damping controls the springs response to the deflection of the car's unsprung weight (**the tire/wheel/hub assembly reaction to bumps**) RacerAlex' Avanced F1 Setup Guide (http://watcher.drivingitalia.net/index.php?name=Downloads&d_op=viewdownloaddetails&lid=23)		

Section	Action	Effect on Balance	Other Effects
21	*Simulating understeer, and oversteer during cornering with the brake, and/or throttle*		
21.1	Increase Brake	Decrease Understeer	This applies to a car that is neutral, or understeering slightly going into a corner, and has a forward brake balance. As you apply brake pressure, the weight balance moves forward, the front wheels gain a little more traction, and the nose points in more. Too much understeer cannot be corrected in this manner.
21.2	Decrease Throttle	Increase Oversteer	If you lift sufficiently during cornering, the rear tyres will break traction, and the rear end will come round. If you do this carefully, you can use this tool to point into the corner. For this to happen, you do need to be carrying enough speed, and you do need to lift a little quickly.
21.3	Increase Throttle	Increase Oversteer	As long as there's enough torque available at the time, you can make a car's back end step out during cornering. You can take advantage of this by lowering the gearing, so you're in the meat of the power band during the corner in which you'd like to induce oversteer.
21.a	These are the essential components of 'trailbraking' and using them as such requires a good touch, and sufficiently sensitive hardware, in a simulator, to feel, and control the effects as they happen. You also have to get the other components balanced so the car doesn't 'snap' around on you, and you have to have enough cockpit time to know what you're feeling, and predict what will happen.		

22		Simulator Controls (Steering wheel, pedals, etc)	
22.1	Increase Axis Travel/Decrease Sensitivity	None	Reduce apparent nervousness; Allow a finer degree of control.
22.a	This is, of course, a matter of personal taste. However, after consulting with a number of hard-core gamers, you are looking for as much control, and as much feeling as you can get. When talking about first person shooters, the general advice was to set the mouse sensitivity as **low** as you can stand. This takes some getting used to, but pays dividends in accuracy, or so I'm told. As this applies to driving simulators, you want as much steering wheel travel as you can stand (It will take getting used to.), and as much pedal travel also. This may seem counter-intuitive, but think about it: You don't want minor twitches to have large effects, and you want to be able to make the finest possible adjustments during maneouvering. With force feedback equipment, this lets you set more, and stronger forces, thus allowing you to feel more of the road without having the wheel ripped from your hands.		
	Note that some drivers turn off the software that comes with the equipment, preferring instead to use the in-game controls alone to set the force feedback, button mapping, and so on. This is also a matter of choice, and possibly system resources, but you may lose some features by turning off the manufacturer's control software. Note also that some controller software has one effect, and the in-game adjustments are overlaid on the system settings, so turning off the controller software requires retuning the in-game settings.		

23		Links	

Caveat

Inclusion of a link in this list is by no means an endorsement. However, I am certainly not an authority on racing chassis tuning, and some of these guys might be. Also, some of these links are quite simulator-specific, so get what you can out of them. I do, on the other hand, wholeheartedly support anyone who would take the time to write something to help the community, and post it for all to read ;-)

My personal preference is to drive a car that feels like a real car, and have a setup that might be usable in the real world. Suffice it to say that *alien* setups are, for the most part, unrealistic. They'd either rip the tyres to shreds, break components, or actually injure the driver. The common response is "We don't drive those cars; we drive these cars." so you decide.

	Yahoo! search for 'trailbraking'	I didn't like any of the explanations I found, so read them all, and practise, practise, practise.
	Racer Alex' explanation of *real* F1 tuning	This is a wonderful, if large, article with pictures. It is in PDF format only, as far as I can tell.
	Old Farts Racing - Driving Tips	Includes Car Tuning 101. Great place to start.

	[Building a Setup for Grand Prix Legends](#)	Paul Jackson's detailed HOWTO. Great place to go second, but some of it is a bit GPL-specific.
	[TKD's post on 'preload'](#)	This is a single forum post, so it may disappear, or move. Tell me if it does, please.
	[JohnP's guide to setting up a GTP car](#)	A forum post once again, and linking to two downloads, [a text version](#), and a [MS Doc version](#). This is very specific to GTP, and N2003-based simulations, and some of it is quite alien.
	[The Physics of Racing](#)	Old Fart's presentation of Brian Beckman's *famous* work. This is math folks, so take a week off before you start reading.

24   *Glossary (My definitions to clarify some of this document. Email me, if you disagree.)*

Simulator
Software and/or hardware that *simulates* something from the real world, as opposed to a *game* which subordinates reality to gameplay, regardless of how good the underlying software is. Need For Speed, and Project Gotham Racing are **not** simulators.

Physics Engine
That part of the software the controls the simulation of real-world physics

Alien
Someone who drives faster than should be possible.

Alien Setup
A setup that is impossible, or unusable in the real world, or one the takes advantage of flaws in the simulator's physics engine.

Gentleman Racer
Someone who would rather let you by, than put you in the wall while you try to make an incredibly stupid pass.