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**A social analysis of an elite
constellation: the case of Formula 1**

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A social analysis of an elite constellation: the case of Formula 1

1: Introduction

From its inception in the early 20th century thinking of Pareto, Michels and Mosca, elite theory has focused fundamentally on its political connections and dynamics (Woods 1998; Scott 1982; 2008). In this way, the term elite blended into that of the ‘ruling class’, and the fundamental question for researchers studying elites was the extent to which their existence challenged democratic and pluralist politics. It was in this spirit that C. Wright Mills (1956) couched his famous critique of the ‘power elite’. It is also in these terms that John Scott has adopted Weberian perspectives to insist on the significance of ‘command’ for delineating elites, thus differentiating them from social classes. Pierre Bourdieu’s (1985, and see Hjellbrekke et al 2011; Flemmen 2012; Denord et al 2011) conception of ‘fields of power’ also insists on the way that elites are defined through their capacity to mobilise exclusive networks. This approach led methodologically to an emphasis on elite power networks, and to the enduring persistence of elite formations who interlock through their social capital.

Over the past 10 years, and influenced in particular by Savage and Williams’s (2008) call for a renewal of elite studies, the focus has shifted towards the more dynamic world of financial elites. Here, elite theory draws on the growing interests in the ‘super rich’ (Irvin 2008; Volschoa and Kelly 2012; Burrows 2013), the ‘one percent’ (Dorling 2014; Stiglitz 2011), and the ‘global capitalist class’ (Sklair 2003). Theoretically, the implication is that older forms of elite analysis might overstate the coherence and consistency of elite power networks, such as those embedded in interlocking corporate directorships (Froud et al 2008). It is sometimes the limits of elite co-ordination which is the focus of attention (e.g. Engelen et al 2012). This current picks up on the recent theoretical insistence that neo-liberal economic forces can be effective even in the absence of conscious mobilising and networking amongst distinctive power elites.

The analysis of elites therefore now oscillates between those arguing for the power of neo-liberal, financial elites against those reinstating the significance of elite social networks and the remaking of ‘power elites’. Owen Jones’s (2014) recent restatement that there is an ‘Establishment’ in Britain is an arresting restatement of the older perspective. The aim of our paper, using a detailed case study of the Formula 1 industry, is to argue that we need to

broaden to a 'social analysis'. Although the significance of political and financial elites is not in doubt, we also need to recognise a wider 'elite constellation'. We should not categorise elites as singular or unitary phenomena, but identify the co-existence of a range of different elite agents. In the case of F1, we argue for the power of a distinctive 'technical elite' which is the product of a long history of craft, skill, and technical expertise (see more broadly, Savage 2010). This allows us to recognise that elites are complex social formations which straddle different arenas, and we wish to bring the technical elements more fully into play so that they can more effectively intersect with the role of finance and politics.

This argument about elite constellations is not simply insisting on complexity. It also directs us to theoretically insist that time and temporality is central to elite formation. In a similar vein to Cresswell's (2010) notion 'constellations of mobility' in his discussion of movement and place, we stress the importance of tracing the impact of the past on the present, historical and geographical specificity, and attention to forms of immobility. Older political conceptions of elites emphasise the persistence of upper class networks, whereas newer financialised approaches tend to see elites as the product of contemporary neoliberal capitalism. We argue that the F1 technical elite is neither simply the product of recent neoliberal financialised capitalism, nor marked by long term elite persistence. Drawing on the arguments of Bourdieu and Piketty, we will argue that they are embedded within a long-term process of accumulation which is distinctive to the F1 engineering industry.

Our paper proceeds by outlining why F1 offers an unusual – but strategically essential – vantage point for thinking about elites more generally. We then consider theoretically how we build temporality into our understanding of the formation of elite constellations, through our analysis of accumulation. We show how the F1 industry itself embeds a distinct model of accumulation in which extreme speed and intensity is dependent on prior temporal accretion. This metaphor directs us to move away from the superficial world towards a deeper and longer term understanding of elite constellations. In the final part of this paper we report a systematic analysis of the F1 technical elite, based on an exhaustive study of senior figures within the teams. We show how this group forms a distinctive technical, engineering and meritocratic elite – yet which is also exclusive and deploys powerful elite practices.

Our study is based on a detailed reading of key sources relevant to the F1 industry, and the construction of a database on the chief engineers, managers and directors in six British F1 teams. The teams themselves vary in size, organisational structure and position titles, which

means the identification of the most senior members is not straightforward. To avoid potential selection bias, we used the names presented as senior management by the teams themselves in their official websites. With the exception of one team which has no such section (Lotus F1), the teams list between 6 and 10 senior management figures each. Typically, though the designation varies, these are positions such as Team Principal; Founder; Chairman; CEO; Deputy Team Principal; Chief Operating Director Officer; Technical Director; Sporting Director; Chief Designer; Director of Engineering; Team Manager. In addition to the 43 individuals derived this way, seven other recent and renowned employees were included on the grounds of their importance to and seniority within the industry, the wealth of data available, and on the condition that they had left the team no earlier than 2012. The status of the industry and of many of the teams' senior management allowed data to be collected in the public domain, through the biographies on the teams' websites, in media publications and the website LinkedIn. Information was collected on position; age; nationality; place of birth; schooling; university education; degree subject; number of years in F1; career progression; salary and hobbies and interests. This extensive prosopographical data base was cross checked (where possible) from a range of different sources.

2: Formula 1 as a critical case study

Formula 1 is a critical case study because it is a hugely successful part of the British economy, valued at £6.3 billion to £8.2 billion (Allen 2015; Sylt 2014).¹ Over the past 15 years, the industry's total revenue has reached £11.1 billion, surpassing the £9.9 billion of its closest rival the FIFA World Cup of soccer (Sylt 2015). The total annual spending of all teams in 2015 was estimated at £1.9 billion, an average budget of £194 million (Walthert 2015). Revenue in 2013 was £1.16 billion and profit was £308 million (Sylt 2014). F1 directly employs 6,000 people, who in turn work with a large network of motorsport suppliers – the Williams team used 3,000 UK companies alone in a six year period (Heaton 2011). These suppliers are also typically based in the UK Motorsport Valley Business Cluster of outer south-east England, which in 2013 comprised 4,500 companies employing a minimum of 41,000 people, with an annual turnover of £9 billion. Motorsport Valley is 'a major source of value-added to the British economy' with an average R&D spend of over 25% of turnover, 'dwarfing even the UK Pharmaceutical and IT industries' (MIA Review 2013). Certainly in

terms of its ratio of reward to size, the F1 sector therefore compares in its sheer economic prosperity with any other, including banking.

What kinds of elite formation are embedded in FI? Despite the roots of motor racing in upper class culture epitomized by the gallant driver, it directly exemplifies the decline of the old fashioned, languid, gentlemanly elite associated with the power of top private schools and Oxbridge, with its Bullingdon Club and Downton Abbey-esque connotations. Fifty years ago, 'gentleman drivers were the rule', exemplified by former 1970s F1 champion and television pundit, James Hunt, educated at Wellington College and son of a successful stockbroker (Arthur 2002 in Ciolfi & Stuart 2013). Hunt milked this playboy image to the full, womanizing and partying, and even playing the part of English eccentric to the point of dining with his pet German Shepherd dog at expensive Mayfair restaurants. However, Hunt retired in the 1970s and the last blast of this image was Johnny Dumfries, Seventh Marquess of Bute, who won the 24 hours Le Mans race in 1988 and remains on the Sunday Times Rich List with a net worth of £110 million. But he hardly exemplifies F1 today.

By contrast, there is a clear warrant for the significance of finance, most notably through the key figure of (recently ousted) Bernie Ecclestone, the current CEO of Formula One Group and business magnate, who has played the key role in placing F1 on the global stage (Ciolfi & Stuart, 2013). In 2016 Forbes listed him as the 435th richest man in the world, with a net worth of \$3.8 billion (£2.6 billion), down from \$4.8 billion (£3.3 billion) in 2013 ("The World's Billionaires" 2016). This put him as the 33rd richest Briton in the 2015 Sunday Times Rich List. The website BornRich.com details his 176 foot superyacht, luxurious Swiss ski resort and 15 bedroom house in Kensington, which remained unoccupied until sold for £57 million in 2004 to Indian steel tycoon Mittal. He is a classic case of the 'working rich', and a long way from being part of a hereditary elite class. Born in Suffolk in 1930, the son of a trawler skipper, his working-class family moved to Bexley Heath in south-east London in 1938 (Lovell 2009). Ecclestone left state school at 15 having failed all his exams except maths (Bower 2011: 17). He was nonetheless admitted to Woolwich Polytechnic in 1946 to study physics and chemistry, where he spent much of his time pursuing his hobby of motorbike racing and left at 16 (Bower 2011: 17). Ecclestone developed his side venture trade of motorcycle spare parts into a dealership, expanding into real estate and loan financing while pursuing his interest in a range of motorsports. Initially as a driver in

Formula 3, Ecclestone moved into F1 in roles as manager, team owner and commercial rights holder over a 60 year involvement with the sport (Ciolfi & Stuart 2013).

F1 also appears to be highly contemporary in exemplifying the unleashing of an elite 'libidinal economy'. This idea, drawing on Lyotard's reworking of Deleuze and Guattari, focuses on the liberation of new libidinal intensities, capitalism's machinic capacity to unleash and satisfy desire. This idea has been elaborated by Nigel Thrift through reflections on how contemporary 'knowing capitalism' proliferates a world of 'glamour' (Thrift 2005; 2008). F1 is massively vested in the proliferation of desire and fantasy, ranging from the presentation of the cars through to the display of glamorous female models on the Grand Prix circuits. This deportment of glamour extends back to the factories themselves. The suspended glass walkways and clean lines of the McLaren Technology Centre in Woking, Surrey were designed by Norman Foster, allegedly costing in the region of £300 million ("Queen opens new McLaren facility" 2004). The industry's quiet professionalism and earnest passion for technical skill accepts this glamour of the spectacle as part of its history and its future as a business in the attraction of corporate sponsors.

'The job of F1 is to help develop the technologies, as with the V6 programme, so that we can benefit the whole economy through the manufacturers..... I think F1 – and maybe I'm a bit of a dinosaur – is a celebration of excess. We have the most powerful engines, we have the best show in motor racing, we have the best parties and the prettiest girls and we should not lose that. We are a show at the end of the day and the show must be maintained.' (Bob Fernley, Deputy Team Principal at Sahara Force India, FOTA transcript 2011)

We fully recognize the significance of finance, and glamour, in the success of F1. However, we want to contest that these themes are adequate. These images of elite-ness are simplistic, dated visions which do not apply to the industry in a straightforward way, nor do they adequately allow us to understand the industry as an elite constellation. Instead, we argue for the need to recognise the significance of a distinctly 'technical elite'. This allows us to go behind the superficial imagery and media saturated stories of specific individuals or glamorous sites to recognize the power of an elite habitus which is a major part of the industry. In the next part of this paper, we theoretically sketch out what this argument entails.

3: The formation of elite constellations: accumulation, embodiment and labour

Our approach to elite constellations argues against for the co-existence of different elite motifs and does not conflate elites with a distinctive occupational profile, income boundaries (such as the 1%), or a set of ascriptive characteristics. We see elite formation as part of a longer term historical process in which its boundaries with a more privileged professional and managerial middle class are porous and pliable. We avoid a language of demarcation and clear boundaries, and instead understand process and dynamics which need to be unravelled over time. Our starting point is Bourdieu's argument:

The social world is accumulated history, and if it is not to be reduced to a discontinuous series of instantaneous mechanical equilibria between agents who are treated as interchangeable particles, one must reintroduce into it the notion of capital and with it, accumulation and all its effects. Capital is accumulated labour (in its materialized form or its 'incorporated,' embodied form) which, when appropriated on a private, i.e., exclusive, basis by agents or groups of agents, enables them to appropriate social energy in the form of reified or living labor. (Bourdieu 1986: 241)

In pursuing this argument, Piketty's emphasis on the longer term gestation of capital is a vital intervention (see also Savage 2014; Piketty 2014b). Understanding social classes as the product of capital, as forces in the process of 'becoming', as dependent on prior investment, provides a more sophisticated way of explicating elites as a dynamic and mutable force. This point leads us to refuse the conventional economists' standard distinction between returns to capital and labour and reifying them into distinctive social classes (e.g. Wright 2014). Heuristically, Piketty, within the spirit if not the letter of Bourdieu, ambitiously prefers to see returns to capital as linked to accumulated historical return and returns to labour as linked to current activity (see generally Savage 2014). As labourers, we have to go out to work each day afresh – we cannot rest on our laurels². Returns to (economic) capital however accumulate on an historical basis, and it is this longer term accumulation which is central for elite formation.

This moves away from the standard sociological move of seeing elites largely in terms of their social and political ascribed characteristics in which it is their social networks, their membership of particular families, clubs, and so on which constitute them as elite. It also

avoids the tendency to treat them simply as the reflexes of contemporary neo-liberal capitalism, as if there is no longer term history implicated in the in the formation of elites and economies of glamour. By contrast, a concern with accumulation allows us to explore the complex dynamics of the accumulation process avoiding the categorical separation of people into different camps, and which more effectively renders elites as agents of change. Piketty's analysis of economic capital shows how those with more to invest earn higher rates of return than those with less to invest. There is thus a structural process, which he shows most directly with respect to the endowments of American elite universities which allows those who have most, to gain most, not only in absolute but also in relative terms. We can thus see how reward and advantage can be built into the organisation of markets and fields and come to have striking outlier effects at the top end which permit those at this top end to enjoy 'Matthew effects' where 'to those who have, more shall be given' (see Ingham 2005, and more generally Savage et al 2015).

It is vital to detach our argument about accumulation from economic logics of 'investment' which imply an individualistic frame of reference. This includes standard arguments about the significance of 'human capital' which is the most usual way of justifying privilege from within a neo-classical economic framing. Both Piketty and Bourdieu join forces in resisting this argument because they see it as assuming that individual motivation, skill, hard work and endeavour is solely responsible for wealth. For Piketty, the 'human capital hypothesis' is 'largely illusory'.

There is little evidence that labor's share in national income has increased significantly.... 'nonhuman' capital seems almost as indispensable in the 21st century as it was in the eighteenth or nineteenth. (Piketty 2014: 22)

Although Piketty is not a Marxist, his Marxist refusal to use the concept of human capital and his preference for delineating 'labour', and above all his concern with temporality, is telling. Bourdieu (1986) makes a similar move in focusing on cultural, rather than human capital. Because cultural capital exists in three related forms, embodied, objectified, and institutionalised, he thus resists seeing it as a purely a self-investment and draws attention to the wider context in which cultural capital can be activated into producing advantages.

Here, the arguments of the German Marxists Kluge and Negt (2015) have considerable resonance, as they are conducting an exercise for labour which parallels Piketty's for capital, in drawing attention to the power of the past over the current. In their interpretation of Marx

‘the bulk of dead labour in a modern society is superior to living labour’ (Kluge and Negt 2015: 129). Labour as a process is therefore embedded in past routines, in which passion, materiality, personality and technique come together. As Fore (2014 23-24) put it, ‘human capital for Negt and Kluge is an unstable assemblage of dissimilar and often ill-fitting components, some flexible and some obstinate..... unlike the simple linear development of fixed capital, living labour power occupies multiple dimensions (sensory, intellectual, psychic, physiological), many of which are incompatible with one another... the labourer meets every abstract operation with a corresponding feat of concretion’

Patrick Joyce’s account of the formation of the civil service elite in Britain from the 19th century is an arresting exemplification. For Joyce this process involved the moulding of subjectivities and personalities through minute devices, ranging from the practice of writing and filing, through to the ritualistic bodily drills and routines imparted at private schools and the Oxbridge college. The British elite was therefore neither a gentlemanly residue nor a pure meritocratic formation but a distinctive assemblage implicated, in Bourdieu’s terms, in a distinctive elite habitus which could be historically persistent.

It is in this spirit that we approach our F1 elite. As we have explained above, we do not think that the kind of gentlemanly habitus which Joyce excavates has such significance today. But we do not think either that characterising the industry’s leading figures as the product of neo-liberal financialised capital is enough either. The historical plate has not been wiped entirely clean. We instead demonstrate how the F1 elite is an historical extension of a distinctive technical and engineering idiom which has also been an important feature of post war British social change more generally (Savage 2010). Standing in contrast to the gentlemanly world of professional expertise, these technical skills embraced cultures of skilled craft work alongside professional expertise and became increasingly instantiated into the practices of information technology and communication. Our argument will be that we can only understand the F1 elite as the obstinate crystallisation of this technical ecology.

4: Accumulation and the long durée in F1

On the face of it, it may appear strange to claim that F1 is characterised by long periods of accumulation. It is renowned as an environment of turbulence, immediacy and extreme innovation. Media reports portray a world of short-termism and instability. The car itself

symbolises this – it passes from being an idea in a designer’s head, through competition, to a museum piece within just 24 months (Department of Trade & Investment 2015). The pace and competitiveness of the industry, Jenkins and Floyd (2001) argue, ‘is represented by the fact that, in fifty years of competition, no team or driver has won the championship consecutively more than four times’ (Jenkins & Floyd, 2001: 949). Yet it is central to our argument that to see F1 in these terms only would be to miss the multiple long term processes of accumulation that not only underlie the industry, but are indeed the very bedrock of its constitution and continued success.

Let us be clear. Financialisation was crucial to F1’s recent success, and Ecclestone was the key agent. The Formula One Group, which owns the commercial rights to F1, is made up of 30 to 40 companies in multiple jurisdictions, for the most part the UK, Jersey, Luxembourg and Switzerland. The parent company of the group, Delta Topco, is registered out of Jersey. In 2001 Delta Topco’s subsidiary SLEC Holdings bought a 100 year lease on rights from F1’s governing body the Fédération Internationale de l’Automobile (FIA) (Sylt and Reid 2012). Its controlling shareholder (35.5%) is a private equity firm called CVC Capital Partners. Expert on the machinations of F1 finance, Sylt (2014) reports that the CVC buyout of F1 in 2006 was driven by its co-founder Donald Mackenzie, known to be a racing fan, and was funded with two loans – The Royal Bank of Scotland provided £645 million whilst £566.3 million came from CVC's Fund IV (Sylt 2014). Since 2006 CVC has made £2.6 billion from share sales and dividend payments, partly funded by a recapitalisation in July 2014 which increased F1’s debt by £2.6 billion (Clancy 2014). This made it one of the private equity firm's best-performing investments. Although CVC ‘typically targets a three to five year investment holding period’, it held F1 for far longer than usual as a result (Sylt, 2014). With the term of the fund being 10 years, and concerns over Ecclestone’s role in the sport, CVC is considering selling its stake for somewhere in the region of \$10 billion (£6.84 billion) in 2016. Along with CVC, other shareholders include American asset management firm Waddell & Reed (20.9%), and the estate of bankrupt investment bank Lehman Brothers (12.3%), the latter of whom has made almost \$2 billion (£1.37 billion) from its investment in F1, a 550% return (Sylt 2014).

Elsewhere, financialization has been associated with a neo-liberal drive to subject business to calculations based on short term ‘shareholder value’. Whilst these financialisation imperatives are real enough in F1, they should not decry the significance of longer term

processes. Behind the complex and turbulent myriad of business deals lie long term, diverse temporal rhythms of debt circulation (Bear 2014), investment and 100 year leases (Sylt & Reid 2012).

‘Even now, after the latest contracts, which have been signed up to 2020, the first thing any new shareholder says to me: it’s not enough. Can’t we make it a longer period? We don’t want the uncertainty.’ (Donald Mackenzie, CVC Managing Director in Sylt 2013)

Team finances, in particular the inequitable reward system, are important to understand: this system is the root of the so-called ‘crisis of F1’ – that ‘in a sport with a turnover of more than \$1.7 billion (£1.1 billion), and which generates very healthy profits for its commercial rights holders, smaller teams can’t make ends meet’ (Leggett 2014). In 2014, two of the smallest teams, Caterham and Marussia went into administration.

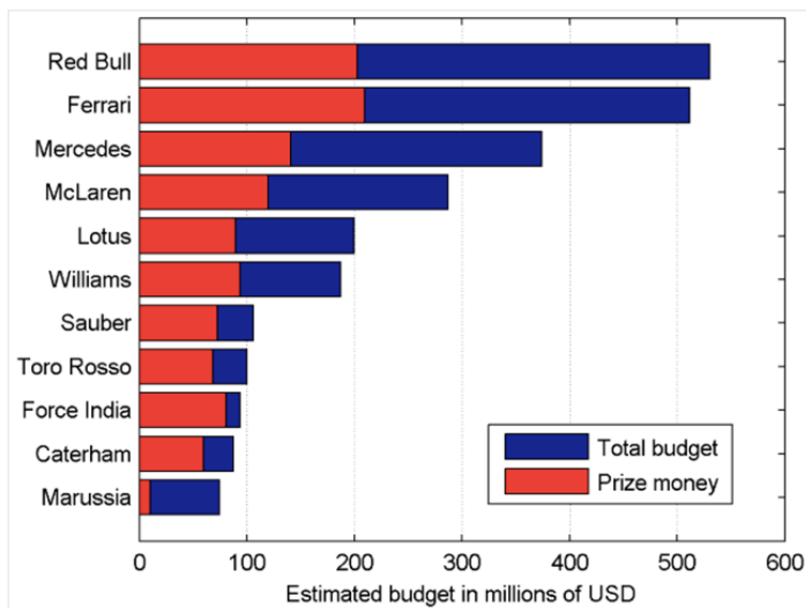
The teams make money from different sources – sponsorship, merchandising, and in some cases from selling their expertise to others teams or other industries. However, their key income comes from prize money. The way this is distributed ensures that success on the race track translates into more prize money, as determined by Schedule 10 of the Concorde Agreement. Of the Formula One Group’s income, 63% is distributed to the teams. In 2013, this meant that out of \$1.6 billion (£1.09 billion), \$700 million (£479 million) went to the teams. From this, around 2.5% is deducted and goes directly to Ferrari, negotiated in recognition of the team’s historical importance to the sport. Ferrari thus gets £12 million automatically, leaving £467 million which is divided into two funds. One half is divided equally between the top 10 teams (approximately £24 million each), determined by their results over the previous three seasons. The other half is divided up on a sliding scale, dependent on where the team finishes in that season’s championship table. The winning team picks up around 20 percent of the prize fund – the higher up you finished in the constructors’ championship, the more money you get (Benson 2014) On top of this there is a separate fund called the constructors’ championship bonus (CCB), of approximately £198 million and split between the largest teams – Ferrari, Red Bull and McLaren, with Ferrari earning by far the most. In addition, the two other teams deemed historically important and who also have permanent places on the rule-making F1 strategy group – Mercedes and Williams – each get payments of around £20.5 million (Benson 2014). Table 1 approximates the amount each team received in prize money from the Formula One Group in 2013.

Table 1: Formula 1 Prize money breakdown, 2013

Team (ranked)	Equal share (\$M)	Merit money (\$M)	Total (\$M)
1: Red Bull	34.12	64.85	98.97
2: Mercedes	34.12	54.6	88.72
3: Ferrari	34.12	44.4	96 (includes extra \$17.5m)
4: Lotus	34.12	37.5	71.62
5: McLaren	34.12	34.1	68.22
6: Force India	34.12	30.7	64.8
7: Sauber	34.12	23.9	54.12
8: Toro Rosso	34.12	20.5	54.6
9: Williams	34.12	17.1	51.2
10: Marrusia	None	13.6	13.6
Caterham	34.12	None	34.12

(derived from Arshad 2014)

This system of prize money thus rewards not just merit, but merit over time and – moreover – the importance of historical relationships. The similarity of the prize money received to the size and budgets of the teams is striking.



(Phillips 2015)

In essence, it means that the teams' main source of income is premised upon a model of accumulation through time, which advantages the older, more successful and larger teams to the detriment, it is argued, of the smaller, less successful competitors. This income in turn prompts both future success and higher income from other sources, such as sponsorship and merchandise. Further to this, the increasing costs of technological advance in high-tech hybrid power units contributes to the 'widening chasm between the haves and have-nots' (Sylt 2014). The game, the smaller teams argue, is rigged (Oliver and Allen 2015). In 2015 two teams, Force India and Sauber, lodged a complaint with the European Union about F1's governance and prize money distribution (Esler 2015).

These long term rhythms in finance are centred on Motor Sport Valley, the home of F1, which is the spatial materialisation of temporal accumulation.

When World War II ended, there were many aerospace engineers [in the area] who were used to building fast, lightweight airplanes to fight the enemy but no avenue for them to use their skills. There were also lots of flat airfields [used during the war], such as Silverstone, and not many cars left so the engineers needed to be inventive and started building lightweight cars to race on the airfields which became race tracks. That attracted those who wanted to race, and with them came suppliers who set up to fulfil their requirements. (Chris Aylett, CEO of the Motorsport Industry Association quoted in Barretto 2013)

Today around 4,500 motorsport companies are based in Motorsport Valley, employing over 41,000 people. This represents around 80% of the world's high-performance engineers (Bevan 2012). With six teams located within an hour of each other, it also means the best engineers can live in one place – ‘people can move teams very easily because they don't have to move house and home’ (Gary Anderson, technical analyst, quoted in Barretto 2013).

Beyond its English heartland, in the global reaches of its Grands Prix locations, attention to the materiality and spatiality of the industry underscores the significance of the accumulation and immobility of infrastructure in F1. Since 1950, the F1 championship has taken place in 70 circuits, of which 45 are permanent, purpose built race circuits, the others being street or road circuits. For the circuits involved in the 2014 championship, 58% have been in use for at least 25 years, 21% for 45 years, and with the oldest being the site of the Italian Grand Prix at 64 years. New circuit contracts are set at ten years, with a combined total running cost over that period around \$925 million (£632 million) (Sylt and Reid 2013).³ Construction costs are also huge. The Russian Grand Prix, held for the first time in 2014 at a road circuit in Sochi, cost \$290 million (£198 million) to construct. This pales in comparison, however, to the \$1.3 billion (£888 million) Yas Marina race circuit opened in 2009 for the Abu Dhabi Grand Prix. Despite these sums, interest remains high, with the new Baku City Circuit, Azerbaijan debuting in 2016 and a second US Grand Prix in New Jersey under discussion (Sylt 2014).

Looking closer at the industry, the production of speed itself is the result of long term accumulation. The industry is highly future-orientated, with careful long-term planning in terms of design and manufacture. Even in the midst of the economic downturn, motorsport-based businesses spent 30% of their turnover on R&D to stay ahead of the competition, compared to 4% in engineering, 6% in automotive and 15% in pharmaceuticals (Barretto 2013). Top teams can spend well over £68 million on research and development (Miller 2013). Red Bull's biggest cost in 2013 was R&D spending – £83 million, up 10% from the previous year. This represents 42% of their total budget of £197 million, the boost in their fortunes being the result of prize money awarded for the previous season (Sylt 2014).

‘This sport is innovation, innovation costs money, a lot of investment, and long-term investment. So we keep investing in F1: that's our focus.’ (Marco Mattiacci, Ferrari team principal in Noble 2014)

There is a distinctive long *durée* of planning in terms of R&D extending to five, even ten years.

‘There are two worlds. You operate in the here and now ... everything in the run-up to the race will be based around being quicker at the track. But then equally all the teams are thinking of 2014, 2015, 2020. Every single detail is done on numerous levels.’
(Simon, F1 journalist)

It is this long term temporal accumulation, intrinsically tied to financial accumulation through time, that creates speed and thus success. Thus ‘it takes a great deal more time and resource to design and make a car than it does to go and race it’ (Ladbroke 2013). ‘Dead labour’ overpowers the short term present, and leaves a powerful imprint.

Using a historical study of the F1 industry from 1950-2006, Jenkins (2010) argues that industries – and on the intra-industry level, teams – create and maintain competitive advantage through ‘dynamic capabilities’, and crucially, he argues, ‘sustaining capabilities’. Dynamic capabilities, typically associated with new entrants, allow quick adaptation to environmental shifts (such as technological innovation or regulation changes) to be used to their advantage against perceived sluggish, rigid incumbents. Over the long term, however, Jenkins argues that firms also need sustaining capabilities to remain competitive and to dominate. These sustainability capabilities are the accumulation of resources such as finance, brand position, knowledge of the industry and – we would add – expertise that provide a firm with the time and space necessary for them to reconfigure their resource base and to respond to change and new competitors. He shows that the large and oldest team Ferrari was able to remain in the top three constructors since 1950, despite many different technological regimes. While it was rarely able to adapt as fast or as easily as other teams, its sustaining capabilities – the strength of resources such as finance (from Fiat), the Ferrari brand, and its political skills in working with the regulatory body (the FIA) – allowed it to retain competitive advantage by ‘slow[ing] down the clockspeed of the industry relative to their own speed of change’ (Jenkins 2010).

But whilst F1 is dependent on the long *durée* of planning and sustaining capabilities in R&D, funding and infrastructure, those in the industry attribute success and speed above all to the embodied expertise of its employees. As Solitander and Solitander (2010) argue, the fiercest competition is not on the track, but for the accumulation of knowledge and expertise. Some designers, as in the case of Adrian Newey, are considered so valuable that the teams will pay \$10.2 million (£7 million) in salary for their services (FIA transcript 2007: 20).

‘Back in the mid-’80s and ’90s you could prioritise the technology and just forget the

people, and say the longer hours you work and the more work you did made you faster on the track. Those days are long gone. It's all about the human and human development.' (Dan, Technical Director)

Accumulation of expertise derives from periods of higher education, experience in the industry, both in terms of lengthy careers in F1 or related industries and long hours on the job. Above all is reference to expertise as an accumulation of tacit knowledge, at the individual and team level. As Solitander and Solitander argue, 'the tacit practices, the philosophy, routines (how things are done)' are more important in F1 than 'the explicit knowledge (what is done)' and the strength of the technology (Solitander and Solitander 2010: 46). Employees commonly speak of the long-term development and deepening of 'common sense', 'know-how' and 'instinct' – an affinity for engineering and the sport.

'It's all about your overall gut feeling' (John Barnard, Designer in Hamilton 2013)

'I see up-and-coming designers ... having a lack of ability to analyse things from a gut feel, from experience ... I say to them "Look guys, this is wrong".' (Nigel Bennett, senior designer at Penske, quoted in Pinch and Henry 1999: 670)

'[It is not] one thing that makes a car go quicker, but a huge amount of small details and all the philosophy that has developed in a team over years' (Pat Symonds, Chief Technical Officer at Williams, quoted in Solitander and Solitander 2010).

This hard-won and time-worn form of tacit knowledge, on which scientific experiments and technical innovations often depend, Pinch and Henry (1999) argue, tends to emerge from 'sets of people who have undertaken long periods of apprenticeship and are integrated into networks of contacts' (Pinch and Henry 1999: 673).

Theoretically we can therefore see F1 as exemplifying how the production of rapid speed is dependent on prior investments – of funds, R&D resources, infrastructure, and human skill and expertise. We have a frame in which we can see how the capacity to reap rewards in the present is dependent on prior activity. It is actually premised on forms of immobility. The 'pulse' of immediacy, of glamour and the libidinal part of a wider time ecology. It is through understanding the temporality of these accumulation processes that we can unravel how elites are not produced simply from contingencies but have a much longer process lying behind them. This is entirely consistent with Piketty's emphasis on how capital, as the sum of historical processes of accumulation, always exceeds the present, and indeed increasingly so

as the stock of capital builds up. Let us explicate this point by looking further at the specific characteristics of those in the most senior positions within F1 teams.

5: The F1 ‘technical elite’

As a highly successful industry, the annual income levels of F1 employees are high, ranging from approximately £14,000 - £140,000 for mechanics and engineers; £270,000 - £6.8 million for managers, chief engineers and directors, even leaving aside the special case of up to £22 million for drivers. With exact information hard to come by, the total spend on pay for the Red Bull team in 2009 was £45.9m across their 529 employees (Sylv & Reid 2011), making an average of £87,000 per employee.

We have only been able to obtain information about the remuneration and/or worth of seventeen of these people in our database (see below). Though partial, a clear pattern emerges. Those who are Chairmen or Team Principals are usually multi-millionaires, or billionaires sometimes reflecting money made outside F1 (notably Mateschitz who made his fortune with the Red Bull drink, Mallya who made his in the liquor industry, and Lopez who is now in private equity), but on other occasions (as with Dennis, Horner and Williams) relying on money made inside the sport. Those doing technical jobs are less well paid, apart from Adrian Newey (who reportedly turned down a salary offer of £20 million to work for Ferrari) but even so fit very easily indeed into the top 1% of earners. The lowest confirmed salary we have found is for Wood, and this £200k is probably at the lower range of any in our database. In short, this is clearly a highly economically advantaged group.

Name	Team	Title	Reported salary/ worth
Niki Lauda	Mercedes	Non executive director	Net worth £100 million
Paddy Lowe	Mercedes	Executive director (technical)	Salary alleged 1 million euros
Ross Brawn	Mercedes	Former team principal (retired 2014)	Net worth £100 million
Dietrich Mateschitz	Red Bull	Chairman	Net worth \$10.7 billion

Christian Horner	Red Bull	Team Principal	Salary £2.1 million, net worth £7.5 million
Adrian Newey	Red Bull	Chief Technical Officer	Salary \$10 million
Frank Williams	Williams	Team Principal	Basic salary £829k (2011), net worth £106 million
Mike O'Driscoll	Williams	Chief CEO	Total compensation £469k
Ed Wood	Williams	Chief Designer	c. 200k
Patrick Head	Williams	Former Director of Engineering (till 2012)	£425k (2012)
Adam Parr	Williams	Former Chairman till 2012	£357k (2009)
Alex Burns	Williams	Former CEO till 2012	£333k (2009)
Ron Dennis	McLaren	Chairman	Worth \$865 million
Martin Whitmarsh	McLaren	Former CEO (till 2012)	'Severance package' \$10 million
Sam Michael	Maclaren	Former technical director (until 2014)	£469k (2009)
Gerald Lopez	Lotus	Chairman and team principal	'billionaire'
Vijay Mallya	Sahara Force India F1	Team principal and managing Director	Worth £750 million

It is part of the self image of Formula 1 that its leaders have been self-made men. We might see this as the most recent incarnation of the Victorian Samuel Smiles 'self-help' ethos, as reworked with the assistance of 21st century technology. Thus, for Jenkins et al (2009), 'they have learned through experience and the 'school of hard-knocks' and therefore they have tended to develop ad hoc practices for managing their organisations' (Jenkins et al 2009: 883). Table 2 reports our analysis of the career trajectories of the F1 elite. In one very important respect, the Samuel Smiles image is entirely intact. 49 out of the 50 names are men, and the only exception, Claire Williams, is the daughter of team founder Frank Williams. The masculinity of this elite remains unchallenged. We can also see that there are only seven senior figures (type 7) who have a business or finance background and have moved sideways into the industry without an engineering or technical background. In this respect, this is a largely in-house engineering elite, which is confirmed by other sources (Goodall and Pogrebna 2014).

This image of being steeped in motor racing runs deep. The accounts for three figures give illustrations of this ethos. Andrew Murdoch, race engineer from Williams, is reported as follows

Andrew's passion for motorsport began in the mud of his native Northern Ireland, where he raced quad bikes as a teenager. He developed an innovative suspension system for his quad in a subsequent A-Level project and then went on to read mechanical engineering at Queens University, Belfast.. ("Andrew Murdoch, Williams Martini Racing" 2016)

For Ron Dennis, Chairman of McLaren

I was always fascinated by anything mechanical. I was an avid user of Meccano, had my train set, built plastic kits of villages. I remember my brother taking me to a Boxing Day meeting at Brands Hatch and being impressed by a formule libre single-seater with a big V8 engine. But it was the creativity of making things that drove me, not wanting to be a racing driver. While I was still at school I spent my weekends hanging around the Brabham workshop at Byfleet, and eventually persuaded them to let me make the tea and sweep the floor, just to get close to the cars. (quoted in Harmer 2012)

Or for Rob Marshall, Chief Technical Officer of Red Bull,

Rob developed a passion for machinery early in life, prompted in large part by his father's work and interests: "My father was also an engineer and worked for a company that made paper-making machines. He had a lathe, so we were always building bits and pieces". ("Rob Marshall, Red Bull Racing" 2016)

We can be more precise about the nature of these trajectories (see Table 2). In six cases (trajectory 1) an early career as driver provides an entrée into the industry. Sometimes, as with Fernley, this was part of a distinctive racer-mechanic trajectory, though in other cases, as with Niki Lauda, drivers came from privileged backgrounds. Leaving aside these drivers, we see only three cases of this F1 elite being able to pursue an engineering route without a university degree (route 6).

Career type	Names
1. Experience as driver provides entrée into F1	Lauda, Wolff, Horner, Williams, Symonds, Fernley
2. Academic engineering route (undergrad/ masters) F1/ motorsport only	Lowe, Cowell, Costa, Newey, Fallows, Monaghan, Smedley, Somerville, Murdoch, Edolls, Head, Boullier, Goss, Morris, Prodromou, Michael, Szafnauer
3. Academic engineering route (undergrad/ masters) – brief experience outside F1, always in engineering	Willis, Marshall, Burns, Neale, Oatley, Roberts, Whitmarsh, Mayer, Chester
4. Academic engineering route (PhD) into F1	Bell, Wache, Wood
5. Academic professional route	O’Driscoll, Parr
6. Apprentice/ other technical route	Brawn, Dennis, Redding
7. Business route	Mateschitz, Claire Williams, Lopez, Gastaldi, Carter, Roy Sahara, Mallya
Unclear/ insufficient data	Hennel, Green, Stevenson

It is true that there is a very clear ‘norm’ where the most senior staff rarely have a background outside the industry, and mostly have engineering or design specialisms. Where they have worked outside F1, it is nearly always in related sectors – motor sport, automotive or aeronautical. Table 2 shows clearly that the dominant career route is the academic engineering route combined with long service in the industry. 29 of the 50 have backgrounds in academic engineering (types 2,3,4) sometimes extending to doctorates.

This pattern conforms to the understanding of industry advisors. Interestingly, Jenkins et al (2009) argue, ‘people in senior positions at Formula 1 teams typically have not been business school graduates or professional managers’. According to Pat Symonds at Williams, they have been ‘without exceptions, people like myself, professional engineers who have been in

the business a long while, but not managers. And in common with most Formula 1 teams, we don't have trained managers; you won't find any MBAs here' (quoted in Jenkins et al 2009).

What is also striking is the type of universities that this engineering elite (in clusters 2, 3 and 4) attended. Although there are some figures who benefited from engineering degrees at elite universities such as Cambridge and Imperial (Paddy Lowe, Geoffrey Willis), the modal pattern is for these staff to be recruited from engineering programmes in the classic industrial towns (such as Birmingham, Cardiff, Manchester, and Southampton)⁴. The F1 elite might be seen as an extension therefore of the older industrial model, the contemporary manifestation of old industrial/craft traditions. A further twist along these lines is that only a minority went to university in London and the South East. 15 went to university in the Midlands, the North, Wales, and Northern Ireland. This pattern of university attendance does not conform the gilded norm of Oxbridge consecration and suggests a more diverse and technical background.

These patterns of university attendance are not typically 'academic' profiles. Instead they are associated with the idiom of 'passion' and 'getting the bug', where entry to university comes after initial interests in motor sport and engineering. They have a habitus associated with motor sports, i.e. not global exchangeable skills but highly specific and focused expertise. Most of the elite have a strong interest in engineering or mechanics (or, though often at a later date, racing) from young age. They commit their leisure time to pursuing these hobbies and are often willing to work lowly jobs in garages or at the race track for free (Ladbrooke 2013).

It follows that this elite is highly networked amongst each other. They have intense social capital and networks arising from years in the industry (and related industries). This accumulation of social capital engenders success. Smith (2012) discusses responses in F1 to innovation and change, which he refers to as 'technological discontinuities'. So called 'competence enhancing' discontinuities involve technologies which build on existing techniques, know-how and an established knowledge base (Smith 2012, 334). 'Competence-destroying' technological discontinuities, on the other hand, occur with the introduction of technologies that are so fundamentally different from existing ones that much of the accumulated expertise that has been built up over many years rapidly becomes obsolete (334). In his discussion of one such competence-destroying discontinuity – 'something that is comparatively rare even in a technology-led sector like Formula 1' – Smith shows that the designer John Barnard was able to revolutionise chassis technology by making the leap to carbon fibre because of his accumulated social capital. Barnard had a large and eclectic

network of leading designers and team owners in F1, contacts in aeronautics and other motorsport industries, and other categories of racing that were technologically and geographically distant from F1. Able to draw on these contacts for knowledge, he thus gave his team, McLaren, a stark advantage over a rival, Lotus, who were also pursuing carbon fibre, but through methods borrowed directly from the existing aluminium chassis technology (Smith 2012: 336, 346).

6: Conclusion

Pulling together the threads of this paper, we make three major points. Firstly, and most descriptively, we have extended the sociological gaze to bring into view a technical elite, at the forefront of a successful and dynamic industry, yet which we have also argued needs to be understood historically and is not readily captured by current sociological motifs. At the apex of all the British teams we see a distinctive crystallisation of a technical habitus, strongly embedded in the industry, and exemplifying intense passions and dedications.

This descriptive point is important but we want to make two further analytical points on the back of it. Secondly, we have deliberately sought to problematize any clear categorical distinction between a distinctive elite and non-elite formation. Or, to put this another way, we need to see elite formation as bound up with wider processes affecting the upper levels of the social structure and not simply a small 1% or some such. Excavating this group takes us away from the very small 'super-rich' towards a more messy assemblage of an 'elite constellation'. This has the further implication of disrupting a certain populist discourse which pits a small group at the top against a large majority. In fact, privilege and accumulation stretch well into the ranks of the upper middle classes.

In elaborating this emphasis on an elite constellation, we argue for the significance of time and accumulation. Here we seek to disrupt the 'human capital' discourse which lies behind a narrow meritocratic view which might justify large rewards. Reframing this within a wider recognition of accumulation on Bourdieu's and Piketty's model means instead that human capital only signifies within a wider ecology in which specific skills and capacities come to earn rewards. In Bourdieusian terms, we need to recognise the institutionalised and objectified, as well as embodied qualities which are implicated in forms of accumulation. This is why we have tried to bring out how the technical elite are in a certain way embedded within the industry itself, and to understand their advantages we need to place them within

this wider historical and spatial context. Elites are thereby constituted through long term processes of accumulation. Making this point shifts argument away from debates about human capital, and high salaries and bonuses being a just reward for endeavour within spot-markets. It focuses attention on wider historical processes by which an entire ecology comes to prize and funnel certain capacities and skills. This is where Kluge and Negt's insistence on historical obstinacy – even in these neo-liberal and global times – is so important.

The accumulation emphasis helps in a further analytical way. It makes us realise that the most advantaged are not categorically different from other social groups, who also draw on certain kinds of capital, but instead should be understood as those who can maximise such advantages. Economically, as Piketty has shown, the return to capital increases proportionately as one's total amount of capital increases. This generates non-linear or outlier effects at the top within the context of 'winner take all markets'.

¹ Despite the Britishness of the industry and its workforce, with 7 of the 11 teams and 14 of the 30 Formula One Group companies being located in the UK, figures relating to the F1 industry are typically quoted in US dollars reflecting the international operation of its finances and sponsorship. The GBP figures here are approximations calculated at the exchange rate as of January 2016.

² Of course this point is qualified by employment law, including certain rights to dismissal procedures, redundancy and the like but this does not alter the fundamental point.

³ Street circuits, while cheaper initially than building a permanent race circuit, have higher annual costs in the region of \$55 million (plus the average hosting fee of \$26 million, which is subject to a yearly 10% increase).

⁴ University attendance can be grouped as follows: Oxbridge/Golden triangle 10; Overseas 6; old industrial/technical redbricks and civics 15; plateglass 1; new universities 3

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