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And if the Global Were Small and Non-Coherent? Method, Complexity and the Baroque[1]

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Introduction

To talk of the global is conjure up a wide range of different images: flow, movement, size, contraction, diversity, difference, universalism, detraditionalisation, branding, standardisation, centralisation, overlap, cultural collision, tension, participation, exploitation, unpredictability, uncertainty, these are just a few of the possible connotations[2]. Whole books have been written about the forms and facets of the global. Here, however, I want to attend to two connotations that attend many if not all of its expressions: those of <u>size</u> and <u>complexity</u>.

To state the obvious, the global is usually taken to be large, as large as could be on earth. Smaller realities such as nation states, people, migrations, or terrorism exist within the global even as they contribute to it. But the global is not simply large. In addition it is usually assumed to be complex because of its high degree of interconnectedness. Much might be said about interconnectedness, but the multiplication of distant connections, the consequent saturation of the local, and the unpredictabilities that result from the proliferation of connections have been widely noted in a variety of contexts and literatures[3]. Note that size and complexity do not necessarily go together. Many smallish things are said to be complex (for instance microprocessors or human brains or cell chemistry) and some large things are taken to be relatively simple (industrial production systems such as steel-making). Again, and to state the obvious, not all large and interconnected things are necessarily said to be global (the government of the UK as opposed, perhaps, to that of the US). But if the intuition is right

– that the global often connotes size and interconnectedness – then this is a combination that is worth attending to. Is the global necessarily large? Is it necessarily tightly coupled? How might we know about it and its interconnections? What are their character? These are the questions that I explore, questions to do with size, scale, connection and method. In what follows I do so by following science, technology and society (STS) philosopher Chunglin Kwa and distinguishing between 'romantic' and 'baroque' conceptions of complexity. The distinction is a convenience – perhaps to be understood as the sketching of two ideal types. The real world is, dare I say it, more complex. Nevertheless I try to show that our predominant understandings of complexity – including the size or scale assumptions I have just mentioned – are expressions of what he calls 'romantic complexity'. Accordingly, my major interest is in articulating an alternative and 'baroque' understanding of complexity, and considering what this might mean for analysis of the local and the global. I work the argument up by using empirical examples from aerospace and aerospace technologies.

Example (1): Formalism

How much will an aircraft be buffeted by vertical gusts of wind, so called 'air turbulence'? This is a matter of interest both to those who fly in and those who design aircraft. Usually designers try to minimise buffeting. Common-sense suggests that this will be less for heavy aircraft, and those that fly slowly. The somewhat more specified common-sense of aerodynamicists adds that the exact cross-section of the wing of the aircraft is very important too. All wings are designed to create lift as they pass through the air, but some are much more sensitive to buffeting than others. That is, the amount of lift they create is relatively variable. To minimise buffeting this variation needs to be minimised. What aerodynamicists call 'lift slope' needs to be pretty stable.

Such intuitions can be formalised. For instance in the design of a Royal Air Force (RAF) aircraft in the 1950s the aerodynamicists at one of the firms, English Electric, linked the three variables I have mentioned above (weight, velocity and lift slope) in the following expression:

$$G = \frac{\text{(velocity x lift slope)}}{\text{wing loading}} = \frac{M.a_t}{W/S}$$

Here G is responsiveness to gusts, M is velocity, a_t is lift slope, and W/S is wing loading (which is weight divided by the area of the wing, weight per unit area)[4]. The expression says that gust response, G, increases with increased velocity and lift slope, but decreases with increased wing loading.

Romantic Complexity (1): Emergence and the Explicit

The formalism is nothing very special. But on a small scale it illustrates techniques for imagining and handling the complex which are common to the point of ubiquity. Following Kwa I will say that these are romantic in style, and argue that we are in the realm of romantic complexity.[5] So what does this mean? The quick answer is that it identifies a number of different elements, and then shows how they are interconnected to produce a new and complex reality. This characterisation conceals a series of assumptions which I will unpack in due course. For the moment I want to note just two.

The first and most fundamental has to do with emergence. The formalism assumes that the whole is greater than the sum of the parts. That is, it assumes that the whole, gust response, is a reality in its own right which emerges as a result of the interconnectedness of its component parts. In this respect it is a simple paradigm for romantic complexity. There is connection; the connection produces something that is emergent; that which emerges is a whole; it is real; it is a reality that is qualitatively different from its component parts; and it can only be grasped if we look at the whole.[6] This is point one.

Point two can be approached by asking a question: how does one grasp emergent complexity? Romanticism is often associated with the non-verbal, the emotional, the spiritual, the artistic – that which escapes and cannot be grasped in words.[7] But Kwa's exploration of romantic complexity in the natural sciences of ecology, biology and meteorology reveals that scientific romanticism is not necessarily mystical either in inspiration or method. Instead, romantic complexity in science typically implies an attempt to render the emergent explicit.

The formalism is paradigmatic in this respect. Indeed it is of use precisely to the extent that it renders the intuitions of the aerodynamicists explicit. It is an engineering simplification (engineers are pragmatists and engineering formalisms are tools) but the more clearly it models the emergent reality of gust response the better.

Example (2): Cost/Size/Lethality

The formalism is an example of romantic complexity at work. But a similar scientific romanticism informs other more ambitious examples. Consider, for instance, the following:

> 'Whilst unit cost has very considerable significance the really significant parameter is made up of cost/size/lethality. The aeroplane is designed to do a certain job – primarily strike – therefore the financial outlay per successful strike is the important thing, or in other words the cost of a given degree of lethality. The achieved lethality is bound up closely with vulnerability and vulnerability is closely bound up with size. Cost per pound of all up weight is of no direct significance.' (1958b 2-3)

This comes from another group of 1950s aircraft designers, those working for Vickers on their own version of the proposed RAF aircraft. Here the emergent reality has nothing to do with the physical features of an aircraft. This has been turned into a subsidiary variable. Instead it has become cost/size/lethality – an emergent but abstract reality which only exists as an interaction between subsidiary variables. Indeed, like the English Electric aerodynamicists, the Vickers designers sought to formalise the relations between those variables.

Romantic Complexity (2): Homogenisation and Abstraction

This is romantic complexity at work again. The real is emergent and is being made explicit. But further features of the style are also visible. First, there is the question of how to model emergent complexities, how to grasp their reality. If the need is to make the relations between the different components explicit, then it is helpful if they can first be made homogeneous. This much is assumed in the aerodynamic formalism. Algebra is a homogenising tool. Variables are made commensurable with one another. But similar homogenisation into the quantifiable is also at work in Vickers' cost/size/lethality calculations. As is obvious, deaths are being related to expenditure. Homogenisation does not necessarily lead to quantification – the latter is a special variant with a contingent link to science and engineering inquiry[8]. But to grasp a reality which emerges out of interaction between its components scientific romanticism it is necessary to treat those components as conformable in one way or another, similar in kind.

Second, homogenisation goes along with abstraction. Gust response is an abstraction, as is lift curve slope. But so too is cost/size/lethality. Indeed it is a reality with no directly physical form at all (at best it would be indirectly visible in statistics about aircraft losses in relation to damage done and costs incurred). The emergent realities of romantic complexity pull towards abstraction, and have decreasingly to do with direct material form.[9]

Example (3): Weapons Systems

Consider the following, which is taken from a British Government White Paper published in 1955.

> 'An aircraft must be treated not merely as a flying machine but as a complete "weapons system". This phrase means the combination of airframe and engine, the armament needed to enable the aircraft to strike at its target, the radio by which the pilot is guided to action or home to base, the radar with which he locates his target and aims his weapons, and all the oxygen, cooling and other equipment which ensure the safety and efficiency of the crew. Since the failure of any one link could make a weapons system ineffective, the ideal would be that complete responsibility for co-ordinating the various components of the system should rest with one individual, the designer of the aircraft. Experience has shown that this is not completely attainable, but it is the intention to move in this direction as far as practical considerations allow.'[10]

Romantic Complexity (3): Looking Up and Centring in Technology and Technology Studies

British government thinking here was being informed both by contemporary US thinking and by the unfortunate experience of several British aircraft projects which had failed to work properly when weapons were mounted on the aircraft[11]. The need was for joined up thinking.

Once again this is romantic complexity at work. Kwa puts it so:

> 'The romantics look up – some all the way up to the world of Platonic forms – and recognize collections of individuals as higher-order individuals.'[12]

In the present case we are not dealing with Platonism, but it is certainly a case of 'looking up'. Looking up: this is the key methodological principle that lies at the heart of scientific and technical romanticism. Look up. See things as a whole. Bring in and incorporate elements that were previously separate. Only in this way you will understand the complex whole. Such is the injunction.

By the same measure scientific romanticism is also about centralised modelling and control. Look up, the romantic sensibility is suggesting, in order to obtain an overview. Look up so you can look down. So the formalism affords an overview of gust response. Cost/size/lethality calculations afford an overview[13]. And the White paper, somewhat haltingly, hopes to afford an overview. Weapons systems (it says) are an aspiration rather than a reality, but in an ideal world 'one individual, the designer', would be in overall control.

This logic of scientific and technical romanticism is at work among the practitioners and politicians concerned with technology. Unsurprisingly it also informs the work of those who study large technical systems:

> 'A system is constituted of related parts or components. These components are connected by a network, or structure, which for the student of systems may be of more interest than the components. The interconnected components of technical systems are often centrally controlled, and usually the limits of the system are established by the extent of this control. Controls are exercised in order to optimize the system's performance … Because the components are related by the network of interconnections, the state, or activity, of one component influences the state, or activity, or other components in the system.'[14]

This comes from the opening pages of Networks of Power, Thomas P. Hughes' magisterial history of electricity generating and distribution. Note that it is entirely consistent with the understanding of weapons systems and weapons technologies described above. Complexity is an emergent phenomenon. Indeed Hughes argues that system-builders are more than usually aware of this and work by looking up and centring. He claims that they are particularly well able to relate different domains together (for instance, physics, economics, the law, and politics) and treat them, within a system logic, as if they were similar in kind – an ability that can also be thought of as 'heterogeneous engineering':

> 'an explanation of technical form rests on a study of both the conditions and the tactics of system building. Because the tactics depend, as Hughes has suggested, on the interrelation of a range of disparate elements of varying degrees of malleability, I call such activity heterogeneous engineering and suggest that the product can be seen as a network of juxtaposed components.'[15]

One implication is that in some of its earlier versions actor-network theory also reflects and carries the torch of scientific romanticism. It looks up and centres in order to discover the emergent. And in doing so, notwithstanding the talk of heterogeneity, it homogenises:

> 'It makes sense to treat natural and social adversaries in terms of the same analytical vocabulary'.[16]

But there are limits to the capacity to model and control everything. The White Paper reflects the impossibility of total control. Discussing this, Hughes follows system theorists by distinguishing between the environment, over which the system has no control, and the system itself. 'An open system', he says, 'is one that is subject to influences from the environment; a closed system is its own sweet beast…' [17]. And even in its most romantic versions, actor network theory notes that the 'translation' of elements into a network is always problematic: that these have, so to speak, their own logics.

Romantic Complexity (4): The Challenge of Global Environment

Is this the end of the story? The end of the ride towards the homogenisation of romanticism? The answer is no, not necessarily. For in this way of thinking the environment is always there. It is always present as an emergent complexity, something bigger, which currently lies just beyond the frontier of the system. This means that the environment is a perpetual challenge, a continuing invitation to the romantic imagination to look up, to include something more, to model the next step in complexity. This means that in practice for the romantic imagination there is a continuing invitation to step up the size of the model and take in more. The call is to look up and work on a larger scale, including more of what sociologists call the 'macro-social'. The pull is towards the emergent global reality which, it becomes clear, has necessarily to be modelled if the components that interact together to make it up are themselves to be understood.

This, I think, is one of the self-set challenges for those who build systems, contemporary or otherwise: to understand, incorporate, and indeed to make the global. But it is also a challenge for those who theorise the building of systems and the character of emergent global realities. Theories about world-systems, global networks, or models of uneven development no doubt carry a range of methodological principles[18]. However, the principles and practices of romantic complexity are powerful and dictate their own intellectual (and real-life) terms. They press the necessity of looking up, where 'looking up' now means addressing that final environmental frontier, the global, and seeking to incorporate it within the logic of a modelled system. Within the romantic imagination the global is told as something very, very large, as something very, very complex, but also as something that may be grasped and held as a whole. Left to its own devices, romantic complexity leads to the holism of grand narrative.

But there is an alternative: one can instead go looking for the global as something that is broken, poorly formed, and comes in patches; as something that is very small, and pretty elusive. To make this argument I will go back to gust response

Example (4): Pilots

> 'The state of the pilots is variously described as "tired," "bathed in sweat," "weakness in limbs," "headache." The main factors causing fatigue appear to be several. … [These include] moderate impacts which continually jar the pilot and throw him about, and occasional large gusts which frighten him by giving the aircraft a vital movement. In addition the pilot had the strain of carrying on with his job, and the worry of whether the aircraft structure would stand up to the treatment.'[19]
>
> '[The pilots are] near to the limit of their endurance, [and] the navigator, who has his eyes on the instruments, will be more prone to sickness than the pilot who looks at the horizon.'

Now we are back with the English Electric design team (the quotations come from an internal company memorandum), and we are starting to learn something about why the designers want to minimise gust response. The memorandum reports a series of flights carried out by RAF personnel at uncomfortably low altitudes and high speeds. These flights were carried out in order to find out how well pilots could operate under extreme conditions of gusting. And the limits which they could not go beyond. G, then, is being investigated empirically, and it will produce a figure that can be fed into the formalism described earlier.

Baroque Complexity (1): Looking Down

I cite this memorandum because it helps us to start the difficult task of imagining a version of complexity which is quite unlike the ideal-typical romantic scientific vision we have so far been exploring. It points us in the direction of another ideal type, that of the baroque. This is not the place for a history of philosophy, but it is worth noting that a baroque sensibility has formed – and informed – an alternative, though subordinate, intellectual style in Euro-American thinking. And it has its philosophers too: most famously Leibniz and most recently Deleuze.

Leibniz' monadology can, as Deleuze insists, be understood as a manifesto for the baroque. Thus Leibniz famously wrote that:

> 'Every portion of matter may be conceived as a garden full of plants, and as a pond full of fish. But every branch of each plant, every member of each animal, and every drop of their liquid parts is itself likewise a similar garden or pond.'[20]

Leibniz is telling us to look for a world of ponds within ponds and gardens within gardens. Such is the baroque sensibility. It looks within a formalism and discovers navigators who cannot work their instruments, pilots with blurred vision, aircrew suffering from nausea or being frightened out of their wits. That is the first step: to look into the pond or the garden or the formalism. But then, if we interrogate the medical or the physiological findings we discover more. We learn about flights in entirely unsuitable aircraft at high speed and at very low altitudes where gusting is worst. This is the second step: ponds lie within the pond, and gardens within the garden. We could press this further: inside those flights we could find the plans and projects of occupational medicine, research projects in hospitals, the adaptation of aircraft, a whole nest of instrumentation, the work of meteorologists. Ponds within ponds within ponds, without limit.

Things are starting to get complex, but what is happening methodologically? I have suggested that we have stepped outside the methodological conditions of romantic possibility. But why, or how? Perhaps the simplest and most straightforward answer is that instead of looking up we are now looking down. We are looking down at (what is sometimes called) 'detail', rather than up to search for 'the broader picture'. And, as a crucial part of this, we are discovering complexity in that detail. 'G', it turns out, includes a host of phenomena, and most of these are simply not visible until we look down and turn up the magnification.

This, then, is the crucial move of the baroque imagination at work. It is an imagination that discovers complexity in detail or (better) specificity, rather than in the emergence of higher level order[21]. It is an imagination that looks down rather than up.

Example (5): Low Level Flight

Let us look at some more specificities from the English Electric brochure:

> '… the essential design compromise … is between high speed flight at low level, and operation from short airfields.'[22]

What is the nature of the compromise? The answer is that the aerodynamics are pulling in two directions. An aircraft taking off from short airfields needs wings with a lot of lift because it has to take off at low speed. But these wings make it more susceptible to gusts in high speed flight at low levels, which would usually be handled by designing a wing with limited lift. So the aerodynamic problem is how to manage both together in a single wing.

But where does this double requirement come from? We know about short airfields and low level flight, but to investigate the pond within the pond within the pond we need to set out on a paper-chase through government archives:

> 'In order to minimise the effect of enemy defences, primary emphasis will be given to penetration to, and escape from, the target at low altitude.'[23]

This is a teaming world filled with enemies, defences, targets, penetrations and escapes. It also contains the claim that 'penetration' at low altitude has to be at transonic speed. This, we are told, is the only way to 'minimise the effect of enemy defences'. But who or what is the 'enemy'? The answer, unsurprisingly, is that it is the Russians:

> 'We shall wish to consider whether there is a requirement for a low level weapon … in case the Russian defences become effective against high flying aircraft …'[24]

Baroque Complexity (2): Specificity, Material Heterogeneity

Ponds within ponds: if, in the baroque manner, we look down rather than up, we do not move off into the abstraction of an interrelated and emergent whole. This is the romantic susceptibility to the complex. Instead it is in the specific and the concrete that complexity is located. Thus we move through gusts of wind and atmospheric properties to RAF documents about what their aircraft should be able to do. Then we move through what their aircraft should be able to do to discussions of other weapons – missiles of various kinds, and other aircraft. And then in turn we move through these to discussions or assumptions about the intentions and the capabilities of the Russians who are taken to be the enemy. Here complexity is increasing with every move, with every insistence on the salience of the specific and the concrete.

Here is another example. What are ‘the Russians’? It is tempting to offer a response in romantic mode, and say that they are a large scale, nuclear power with more or less hostile intentions which form a crucial part of the environment of the RAF. More ambitiously, one might venture that they are (or were at the time) a part of a world system or network of power, deterrence, or influence. In this way one might seek to theorise such an emergent complexity.

But a baroque response is different. Instead of looking up it looks down. In practice this means that it might ask how ‘the Russians’ manifest themselves specifically. Where is the snow on their boots? The answer is empirically interesting. This is because the Russians manifest themselves in the work of the Operational Requirements (OR) Branch of the Air Staff of the RAF. And if we look down further? It turns out that at the time the OR Branch was a small group of young high-flying RAF officers who were paid to imagine the future shape of warfare. But how (more detail) did they inform their imaginings? The answer is that they spoke to ‘intelligence’. They also asked those designing possible future RAF aircraft about their expectations, about what aircraft types might be possible in ten or twenty years time. They did this on the not unreasonable assumption that Russian designers might be thinking in much the same way as their British colleagues[25].

All of this is fine, but then we can ask where this leaves the Russians. Are they out there in the global environment, a part of the global context for our defence system? Or are they within the system, which would be, so to speak, a way of posing the question, assuming that we are dealing with a global world-system? The answers to these questions are interesting, but they are both responses which elaborate a version of a romantic sensibility. They work on the assumption that the global is big. But if, instead, we ask where the Russians are from the point of view of the baroque, then the answer is quite different. Rather than forming part of an environment or a larger system, they are instead (I simplify, but only a bit) within the offices and the conversations and the practices of a few British designers and strategists.

In its holist imaginings romanticism treats the environment indeed as a whole. Whether in aspiration or reality it then tends to homogenise the environment and bring it within the system, for instance producing a world of networks or flows. But what we are learning is that the baroque simply does not work in this way. It looks down to discover the concrete, and then it discovers complexity within the concrete. It also discovers heterogeneity – including material heterogeneity. We are not short of examples. The ponds within ponds have led us through formalisms to aircraft, aircrew, and human physiology. They have led us through gusts of wind to aerodynamics, and then on to official strategy documents and those who have drafted them. And then they have led us into government bureaucracy and the administrative machine. And the Russians? They have turned up as sets of assumptions traded in conversation or memos between young men working on the same corridor. The holistic environment of romantic complexity has been turned into a set of endlessly unassimilable and materially heterogeneous elements. This is complexity understood within the baroque imagination.[26] Perhaps, then, we need to say that the global is very small, and perhaps we need to add that the global is heterogeneous, unassimilable, and within – or at least that it may be.

Example (6): Controversy

We have seen that the formalism is written so:

$$G = \frac{M.a_t}{W/S}$$

We have talked of M, speed, and lift curve, a_t. I'm going to miss out on wing surface area, S, and move on to W, weight. The practices of algebra tell us that as weight goes up G falls.

This, as we've seen, is an aerodynamic good. But how does W get fixed? The answer is, only with difficulty.

> 'From the very beginning of our study we believed that if this project was to move forward into the realm of reality – or perhaps more aptly the realm of practical politics – it was essential that the cost of the whole project should be kept down to a minimum whilst fully meeting the requirement.' (Vickers-Armstrong, 1958b, 2)

The Vickers designers wanted a small aircraft, one with a single engine. That is what the cost/size/lethality arguments were all about. They also reasoned that a small aircraft would sell better overseas, and that since it would fit into aircraft carriers it could be sold to the Royal Navy. The English Electric designers thought differently:

> '[A single engine aircraft] has not been considered, due to the overwhelming pilot preference of a twin-engined arrangement … because of the very high accident rate of supersonic aircraft following total engine failure. …. The argument for two engines … is reinforced by the need to operate several times further from base …'(English Electric, 1958, 1.S.6)

So W would be larger for English Electric, and they were not alone in this preference. The pilots were with them, and the RAF. But the policymakers in the latter had a further reason for wanting an aircraft with two engines: they did not want it to be able to fit onto an aircraft carrier. They needed a big aircraft. The reason for this was that if they were willing to accept a small one then they might find that they were being made to buy different smaller, and (in their view) inferior aircraft already being built for the Royal Navy. But the Navy were not impressed either, reasoning that the RAF aircraft was a long way off and might not materialise at all. They were quite happy with their own aircraft. A bird in the hand … . Whereas, in contrast, the Treasury thought that a small, single-engined aircraft (and preferably the cheaper Navy version) was all that was needed since this would save most money.

After much argument the RAF was allowed its twin-engined aircraft.[27]

Baroque Complexity (3): Monadology, the Implicit, the Continuous and the Non-Coherent

If we magnify G we find W. If we magnify W we find a set of furious in-house debates, arguments and tensions, pulling this way and that, a controversy. So what should we make of this? One possibility to imagine it in romantic terms. This would lead us look up into the environment and argue that a larger context of bureaucratic interests and powers was shaping the controversy. It is, indeed, perfectly possible to do this, and there is a tradition of writing on bureaucratic politics which precisely ploughs this productive furrow[28]. And though this line of reasoning doesn't lead all the way to the Russians, it is macro-social even so. Big social institutions and their relations are being related. The environment is being homogenised, modelled and rendered explicit in an attempt to make sense of the complexities of an emergent whole. This is the romantic sensibility. But the baroque alternative leads in us in another direction, down rather than up into complexity. Let me make four points about this.

First, when it looks down, the baroque sensibility opens itself up to the discovery of <u>everything</u>. There are ponds within ponds within ponds within ponds, and so on, endlessly. Leibniz tells us that:

> '… each simple substance has relations which express all the others, and consequently it is a perpetual living mirror of the universe.'[29]

The argument, which sits ill with romanticism, is that <u>everything is already within the individual</u>, in G, in gust response, in cost/size/lethality, in the pilots, or in lift slope. Wherever we look everything is already present if we just look hard enough.

Second, this, as is obvious, also means that there are no limits to G, that it stretches off for ever. Kwa puts it so:

> '… the historic baroque insists on a strong phenomenological realness, a sensuous materiality. … this materiality is not confined to, or locked within, a simple individual

> but flows out in many directions, blurring the distinction between individual and environment.'[30]

So this is the second discovery: that there is no distinction between individual and environment. There are no natural, pre-given boundaries. Instead there is blurring. Everything is connected and contained within everything else. There are, indeed, no limits[31].

But, point three, if everything is present then this in turn implies that there are limits to what can be made explicit. Again Leibniz is very clear on this point:

> 'In a confused way [monads] all go towards the infinite, towards the whole; but they are limited and distinguished from one another by the degrees of their distinct perceptions.'[32]

Perhaps then, some individuals make some things explicit, and others, others. Perhaps some make more explicit than others (this is Leibniz' own position). But either way the baroque sensibility to complexity is that it is endless and that most of it cannot be known in as many words. This means that unlike the romantic, the baroque is tolerant of the implicit. To know something, indeed to know it well, is not necessarily to make it explicit. It may be enough to reflect or refract or enact or embody it. Indeed, in one way or another, everything will in any case be reflected or enacted or refracted or embodied in whatever is present. So not only is there no possibility of modelling the whole – for instance the global. But, more importantly, it is possible to imagine knowing this well by implicit means.[33]

This leads to point four, which has to do with non-coherence. The example of the formalism shows that the latter conceals the bureaucratic non-coherence that it also refracts and embodies. It 'knows' this non-coherence indirectly, in 'a confused way' (as the somewhat uncomfortable translation renders Leibniz' words). The romantic escape here is appealing. It is tempting to say that 'really' there is a larger coherence of bureaucratic power-plays and social interests. But the baroque sensibility looks down rather than up, and suggests, instead: that the different and countermanding views may not add up to a whole, that the formalism carries a continuing set of differences[34]; that there may be no need to pull it all together; and, indeed, that it is impossible to pull it together and that to try to do so is to miss the point.

But this is not just a choice between preferred styles of analysis, between the romantic and the baroque. There is also a philosophical issue of some importance at stake here within the baroque. This is whether or not different individuals or instances within a set of relations are indeed consistent with one another, or as the philosophers put it, 'convergent'. Leibniz assumed that this is indeed the case. He argued that they have been arranged in that way by a beneficent Creator. Recent exponents of the baroque have tended to avoid this assumption. Deleuze is a case in point. Commenting on the metaphysics of Alfred North Whitehead, he argues that the latter does without Leibniz' assumption of the harmony of convergence.[35]

There are no knock-down arguments for preferring divergence over convergence. This is indeed a matter of metaphysics. One either believes in a some equivalent of a convergent Creator or one does not. Nevertheless my argument about non-coherence here follows Deleuze rather than Leibniz. And if we follow this path, and assume baroque divergence rather than convergence, then the imagination of complexity is not simply vague and in parts 'confused' – as Leibniz indeed suggests. It is also (and this is the important additional move) patchy and at best only partially coherent. The implication is that there is no possibility whatsoever of an emergent overview, and this is not simply because it is neither possible nor necessary to make what is known fully explicit – though this is indeed the case. In addition, it is because there is no final coherence. There is no system, global order or network. These are, at best, partially enacted romantic aspirations. Instead there are local complexities and local globalities, and the relations between them are uncertain.

Conclusions: Is this a Loss?

Romantic	Baroque
looking up	looking down

complexity emergent	complexity within
complexity big	complexity small
holism	non-coherence
making explicit	accepting implicit
homogeneity	heterogeneity
abstraction	specificity, sensuousness
centering view	no overview

Following Chunglin Kwa I have set up two ideal types or sensibilities for imagining complexity, size, and the character of inquiry. As I earlier noted, particular explanations and inquiries fall between and include elements of both. Weber's ideal type tool was, precisely, a way of imputing a limited coherence to the unknowable, and hence belongs as much to the romantic as the baroque. And to set two up styles and to contrast them as I have here also reflects the romantic as well as the baroque[36]. In a performative contradiction it characterises the baroque by making it explicit and abstracting it. This tells us something about the predominant romanticism of academic conditions of possibility: the baroque is very hard to achieve within the canons of the academy, and those who attempt it are easily treated as confused and unclear[37].

Nevertheless the contrast is instructive precisely because of the dominance of the romantic. Thus the baroque imagination tells us that the global is never (I use Hughes' term) its own sweet beast either in reality or aspiration. From a romantic point of view this means that something has been lost: a baroque account is never complete since it loses the possibility of an emergent overview of complex globality.[38] But if we lose the visions and the hopes of romanticism we also lose its blind spots. Other realities, questions, and methodological or political possibilities are brought within the conditions of possibility.

In this paper I have considered the issue of size or scale. The question is: is the global large? The romantic intuition of emergent complexity answers this question in the affirmative. Yes it is large. Correspondingly, the local is inserted into the global somewhere down the hierarchy of emergence. If, however, we do not take the romantic route then this does not follow. On the contrary, the global is situated, specific, and materially constructed in the practices which make each specificity. (Think of the way in which 'the Russians' cropped up in the gust response formalism). It is specific to each location, and if is bigger or smaller then it is because it can be made bigger or smaller at this site or that.

A baroque sensibility suggests, then, that size is a specific accomplishment rather than something that is given. It makes the same assumption about the relations between sites. Wash away the assumption of convergence and one is left, as I have tried to suggest, with uncertainty about how this global relates to that. Perhaps they are coherent and they move easily from one site to the next. Perhaps, then, size relations are transitive, but perhaps they are not.[39] The implication, then, is that there are many large (and not so large) things, and many globalities. But the links between them? These are uncertain, contingent, to be explored, and are not given in a general logic of emergence.

The baroque sensibility treats the global as specific. It changes shape and size and it travels only uncertainly. But this suggests (to put it voluntaristically) that there are 'choices' to be made. One may choose, participate in, and enact, one's version of the global and, indeed, one's version of scale. The voluntarism is too simple, but it helps to make the point. Enactments of globality, complexity and size are not simple descriptions of a larger and emergent reality. Rather they are moments which pull on this or that materiality of the obscurity of Leibnizian 'confusion'. And without the assumption of convergence this 'choice' is given added point. Which versions of the complex, which versions of the global, are to be preferred, enacted, and transported?

Nothing, then, is neutral. Big and small, local and global, these are being made this way here and that way there. To write is to collude, but the issue is how. The seductions of romantic complexity are real enough, but they narrow the possibilities by enacting (however partially) a monocular version of big and small. By contrast the baroque opens up alternative possibilities. This is why, at the end of the day, I profoundly disagree when macro-social romantics tell me that refusal to acknowledge large scale social structures is self-indulgent or quietist. Indeed quite to the contrary, the refusal opens up a politics of scaling and size that lies far beyond the conditions of possibility set by the romantic understanding of complexity. But to see this way one needs to sense that there are realities which can only be caught, associatively and indirectly, at the edges of perception[40]; that there are things that do not and could never fit the romance between complexity and explicit emergence.

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Endnotes

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[2] I draw this list in part from Franklin, Lury and Stacey (2000).

[3] On complexity, its relation to the social, and the character of unpredictability, understood in part through the lens of complexity theory, see Urry (2002). In a very different idiom, and here on unpredictability and interconnection, see Perrow (1999).

[4] Some specificities: M is speed in Mach units, a_t is lift slope at the speed of sound (transonic speed), S is surface area, and W is weight. G is gust response, a measure of sensitivity to vertical gusts. The aim is to keep G to an acceptable level.

[5] See Kwa (2002).

[6] Much of this reasoning follows that of Kwa. However, the point about qualitative change is emphasised by such writers as Alvin Gouldner and Karl Mannheim, and can, of course, also be found in Marx. See Gouldner (1973), and Mannheim (1953).

[7] In the context of social science see, in particular, Gouldner (1973).

[8] Theodore Porter explores the relations between professional weakness and the need for external justification in his (Porter: 1995). Related arguments are developed by Ian Hacking (1990) and Nikolas Rose (1999).

[9] A version of this argument has been made in different language by Bruno Latour. See his (1990).

[10] See HMSO (1955)

[11] The aircraft tended to fly fine by themselves. And the weapons tended to work well in isolation too. It was when aircraft and weapons were combined that things went wrong.

[12] See Kwa (2002).

[13] Albeit one rejected by the government customers who were more attached to the specificities of pilots and aircraft than they were to abstractions such as the relation between lethality and cost.

[14] See Hughes (1983).

[15] See Law (1987).

[16] Ibid., italics in the original.

[17] (Hughes: 1983).

[18] Instances include the work of the world systems theorists such as Wallerstein (1974; 1980), world network theorists such as Castells (1996), and theorists of uneven development such as Harvey (1989; 2000).

[19] From English Electric (1957)

[20] (Leibniz: 1973a).

[21] On Leibniz and the baroque see Deleuze (1993), and again Kwa (2002).

[22] English Electric (1958 2.1.9)

[23] Air Ministry (1958)

[24] Air 8/2167.

[25] I learned this from interviewing participants who were in several cases quite sceptical about the circularity of this exercise.

[26] Having noted earlier that ANT has at times revealed a propensity to lean towards the romantic, here it is appropriate to add the corrective: that in many ways it also reveals baroque tendencies. This is exemplified its concern with the sensuous materiality of practice and the scale-destabilising implications of this materiality. See, for instance Callon and Latour (1981), and in a different mode Law (2000).

[27] This process is discussed in more detail in Law (2002).

[28] See, for instance, Sapolsky (1972), and in a somewhat different idiom, MacKenzie (1990).

[29] Part of section 56 of the Monadology, (Leibniz: 1973b).

[30] Kwa (2002).

[31] Interestingly, this is one of the complaints sometimes addressed to actor-network theory, where it appears that the networks ramify off endlessly and in every direction. And indeed they do. It becomes clear that this is only a complaint from the point of view of romanticism. Its concern with the ramification of networks suggests, as I have already noted, that actor-network theory is as much (perhaps more) informed by a baroque than a romantic sensibility. This much is clear from Latour's Irreductions (1988).

[32] Part of section 60 of the Monadology (Leibniz: 1973b).

[33] For further discussion see Law and Singleton (2002) and Law (2004).

[34] In an analysis that is also baroque in inspiration, Annemarie Mol (2002) argues persuasively against the notion of 'closure', which has been common in science and technology studies, and in favour of the continued existence and of and interaction between different and not necessarily coherent parallel practices and their realities. In the present case a decision in favour of a larger aircraft was made, but in a context of continuing sniping from the sidelines, it can be plausibly argued that that decision was not, as it were, fully put into practice, and the continuing tensions ultimately undid the project.

[35] See Deleuze (1993) and Kwa (2002). Other recent versions of the baroque raise the same issue. See, for instance, Benjamin (1999) and Hetherington (1997).

[36] I am grateful to John Urry for this point. Interestingly, Donna Haraway, another writer strongly influenced by the baroque, has analogous problems with a similar binary list. See Haraway (1991) page 194.

[37] Consider, for instance, the continuing debate about the status of Walter Benjamin's 'arcades project' (Clark: 2002).

[38] From the baroque point of view the idea makes no sense, and to pretend otherwise is misleading and indeed potentially dangerous. There have been enough warnings of the dangers of over-enthusiastic romanticism. See, in particular, and most influentially, Zygmunt Bauman (1989).

[39] This is an issue I have discussed elsewhere. See Law (2000).

[40] See Ehrenzweig (1993). I am grateful to Bob Cooper for drawing my attention to this argument.