FREAKS OF NUMBER

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+ There is a very intriguing book from 1893, with a second edition in 1905. Written by Maurice d'Ocagne, a Professor at the l'Ecole des Ponts et Chaussées, *Le Calcul Simplifié par les Procédés Mecaniques et Graphiques* is subtitled 'a history and description of instruments and machines of calculation, tables, abacuses and nomograms'.[1] Much of the book is exactly that: a set of descriptions for increasing the speed and accuracy of numerical calculation. The book opens with a standard piece of puffery, noting the substantial importance to all branches of modern science and industry of the art of calculation.

The text is notable for a number of things. First, it is perhaps one of the first examples of software criticism. D'Ocagne makes developed comparative portraits of each of the kinds of calculating machines and techniques available in 1905 (indeed the book is bang up to date, with several last minute addenda on new machines). All the heroes of computation and their amazing gadgets are there: Pascal, Babbage, Leibniz, Napier. But there also appears a set of more everyday pieces of equipment, cash registers, arithmometres, and so on.

Alongside the super-accurate ironmongery, one of the techniques promoted by the book is that of Nomography. This lost art is essentially that of producing gridded visual diagrams showing the results of what would otherwise be mental calculations. In a reverse of today's expenditure on processor power, these are graphics for the purpose of calculation, computer graphics. In his *Universal*

History of Numbers, Georges Iffrah describes d'Ocagne's work:
'The first major step towards modern concepts was taken in 1893 when Maurice d'Ocagne discovered the famous collection of calculating machines in the Conservatoire des Arts et Métiers as well as the equally important collection belonging to General Sebert (now owned by IBM). Since he could not relate these machines to any contemporary mechanical theory, d'Ocagne had the highly original idea of placing them into categories for which he developed his own hierarchy. To achieve this, he borrowed his classification criteria from biology. From 1905, the date the new edition of his *Calcul Simplifié* appeared, he always referred to "the comparative anatomy of calculating machines". This stripped mechanical calculators of the uniqueness they had previously enjoyed and which conferred on each its peculiar bizarreness or curiosity. Without question, d'Ocagne's approach paved the way for an axiomatic theory of mechanical calculating machines. After that, the study of machines was viewed as a discipline that could be rational, objective and therefore scientific.' (2000: 228)

Actually, the book is not quite as rigidly scientific as Iffrah has it. D'Ocagne acknowledges in the introduction that a number of things appear in more than one category for the purposes of comparison. The book is more aimed at increasing the understanding and availability of techniques of calculation.

Another thing that is fascinating about this work is that it begins, after the general assurance that arithmetic is important to a number of trades and professions, with a list of what can only be called freaks of number. D'Ocagne makes an inventory of individuals for whom the power of calculation reaches a prodigious intensity:
'The history of calculation has conserved the names of several of them. We can cite: the young Lorrain Mathieu Le Coq who, in Florence at eight years old, filled Balthasar de Monconys, in his third voyage to Italy (1664) with wonder; Mme de Lingré, who, in the salons of the Restoration, made, according to Mme de Genlis, the most complicated mental operations in an atmosphere full of the noise of conversations; the negro slave Tom Fuller, of the state of Virginia, who, at the

end of the 18th Century, died at the age of twenty-four without being able to read or write; the Wurtemburgeois shepherd Dinner; the Tyrolian shepherd Pierre Annich; the Englishman Jedediah Buxton, a simple thresher from a barn; the American Zerah Colburn who was successively an actor, Methodist deacon and teacher of languages; Dase who applied his faculties of calculation, the only ones that he had, to the table of prime divisions of Burkhardt for the numbers 7 000 000 to 10 000 000; Bidder, the constructor of the Victoria Docks in London, who became president of the Institute of Civil Engineers and who transmitted in part his gifts for calculation to his son Georges; the Sicilian shepherd Vito Mangiamelle, who possessed, besides, a great facility for learning languages; the young Piemontais Pughiesi; the Russians Petrof and Mikhail Cerebriakhof; the shepherd of Touraine Henri Mondeux, who came into great reknown during the reign of Louis-Philippe; the young Bordelais Prologeau; the human-trunk Grandemange placed in the world without arms or legs; Vinckler, who was the object of a remarkable experience at the University of Oxford. Finally we have today the marvelous arithmetical tours de force of the Piemotais Jacques Inaudi, who was also a shepherd at the beginning and who has found an emulator in the person of the Greek Diamandi.' (1905: 3-4)[2]

D'Ocagne ascribes much of the facility of calculation found so often in this list amongst shepherds because of the way in which, even in childhood, calculation can provide a way of passing the time whilst guarding the flock. To him, such powers of calculation are extremely rare, and often won at the expense of other faculties.

The fascination with numerical prodigies continues today, although it is often more radically clinicalised as, for instance, romantically described in the film *Rain Man* (1988). Indeed in a number of recent films the quadrivium or four arts of mathematics of ancient Greece (arithmetic, music, geometry, astronomy) have appeared as existing on the border of neurological disorder. What is interesting though is that this list of numerical freaks appears at the beginning of a sober text on the means of automating mathematical operations. It is as if it were

something that has to be acknowledged, marveled at, but disowned. The chemist describes the alchemists. This shudder of recognition and of admiration passes. The thing is safely out of their clammy hands, but the continuum between these persons and these machines is established.

There is however something in this freakishness that is amplified by calculation machines. It is something that provides a figure of the monstrous, the numerical grotesque. Whilst the shepherds, the slaves, the human trunks are marginalised, in the case of the former literally at the edges of habitability up the hills grubbing for grass, they are also, once their talent or curse is recognised, wrenched into the centre of attention as a talismanic weird cousin.

For the comparative anatomy of calculation devices, these are freaks, because they have this power lodged into their heads. Such power should be built only as the result of an anatomy that makes itself comparable by means of abstraction by a machine. That such a continuum exists is the result of a key quality of mathematics as a media - that it is immensely abstract, but at the same time, utterly concrete.

I make this detour into the nineteenth century because this period provides a veritable thunderstorm of cloudburst upon cloudburst of arithmetico-material drives. We have Charles Darwin, who spoke of the 'geometrical powers of increase' inherent in reproduction and variation of species: 'There is no exception to the rule that every organic being naturally increases at so high a rate, that if not destroyed, the earth would soon be covered by the progeny of a single pair.' (1985: 117) It is also the century of Karl Marx, who mapped the chaotic, ruinous and massively fecund explosion of the factory system and of capitalism. In his book *The Taming of Chance* (1990), Ian Hacking uses the term, 'the avalanche of numbers' to describe the birth of statistics and the attempt to map and control populations in terms of health, criminality, births, deaths, marriages, and physical non-human phenomena occurring at the same time.

On the scale of numbers, post-industrial society is perhaps something that occurs when the 'avalanche of numbers' of Hacking, an enormous and self-generating torrent of factualisation, tabulation and recording meshes with numericalised labour, mechanisation and product and informational standardisation and variation.

Arithmetico-material drives occur as a result of the application of the very fruitful perspectival trick that Newtonian (1642-1727) science pulls. This form of science, 'Consisted in isolating some central, specific act, and then using it as the basis for all further deductions concerning a given set of phenomena.' (1985) In its strongest form it was led by champions such as Pierre Laplace (1749-1837), whose determinism was such that he made the well-known claim that if the position of every particle could be but known, 'Nothing would be uncertain, and the future, as the past, could be present to out eyes'. But one can be determinist and be rather more modest.

Numericalisation is the process of turning a live thing, a dynamic, or an object into something that exists as a numerical representation of its properties, or that has such an abstraction of itself embedded within it. Arithmetico-material drives are those forces produced in the coupling of numericalisation or abstraction with the capacities and propensities of matter. Arithmetico-material drives are firstly generated in the moment when matter is formed, according to the mathematical model of it given by such science. One result of such objectivisation is the 'Standard Object', the modular component typical of globalised trade, but with its roots deep, for instance, in the licenses afforded the monopolistic guilds of the Middle Ages, and the history of trading generally. Everything from ships to pizzas are quality assured, subject to rigorous treaties and processes of standardisation. These are typical results of industrial production. The second stage is when this process of standardisation becomes so abstracted it becomes amenable to massive acceleration in production. The human work put into the production is scanned, abstracted and multiplied by means of machinic energy. Once turned into numbers, registered as a pattern, the actor of the work can be discarded

and the pattern accelerated. When hooked up to processes of production we get the discovery that, according to Walter Benjamin, '...the speed of traffic and the ability of machines to duplicate words and writing outstrips human needs. The energies that technology develops beyond this threshold are destructive. First of all, they advance the technology of war and its propagandistic preparation' (2002: 266-7). Overproduction, the massive churning of ordered matter and of markets: one might also say that any development beyond this threshold might be captured by forces other than war, for redistribution, for the reshaping of work, for burning. One of the aims of art is to capture this excess away from the apparatus of war.

Opposed to the Platonism of mainstream computing which finds its beauty in the most apparently simple, the most purely expressed of formal resolutions to a problem, the recognition of arithmetico-material drives reaches its current apotheosis in software. The logically mighty Turing machine might be trapped in the weakling body of a PC, but it provides an environment which is computationally almost unimaginable to its users. Every household and every workplace with a computer contains its own avalanche of numbers. That many are now networked allows arithmetico-material patterns of turbulence or gentle weather to move from hard drive to hard drive, in modes including the various forms of voluntary or involuntary file-sharing, such as peer-to-peer networks or viruses.

We can see too that much digital art is often the turning loose of these powers into the contexts of established art genres. Thus the most typical 'digital' reversioning of a portrait is the morph, the simultaneous assault on and reconfirmation of identity by the availability of processor cycles and of algorithms to compute various kinds of medium terms, variables in between states; to find edges; to match patterns of light intensity.[3] What does it mean to throw the core digital archetypes: loops, variables, arrays, conditionals, and so on into the context of art? By the sheer onrush of available permutations the historically established art genres are shredded, but at the same time they become the loci around which

activities are fixated. I mean this in the sense of the most willfully tedious work, typical of, say, the grimmer corners of Siggraph, but also about work which aims to deploy this reconstituting turbulence in ways that use generic limits to test out and mutate calculational monstrosity itself.

Equally it is not just self-consciously computational art which allows ways of sensing into these processes. In his paintings, Keith Tyson shows these spaces in the various ways in which they are constructed, as jargons, as diagrams, as routines, as the art gestural jargon of splashes and drips, as recordings of certain kinds of material bodily dynamism. I like the way he uses theorems and equations as part of pop culture, as cosmic doodles. At once schematic and sploshy, they are enormously vivid and multidimensional.

Further into the numerical grotesque, and thus beyond the boundaries of contemporary art good taste, M.C. Escher created landscapes of ink on paper, possible yet impossible according to the 'laws' of perspective, these laws which exist only as a loophole hackable by excessive feats of draughtsmanship. Equally as deft an exponent of the geek sublime, but in text, J.G. Ballard's story *Report on an Unidentified Space Station* (1990) is of an endless space station being explored by a crew who will never reach its end. Both of these are made possible by the simplest linking devices of realist representation, a linear narrative with a narrator or a line dividing one space from another. Telephone call-centres too, created by means of digital exchanges, a structured progress through an ordered sequence in which potentially thousands of people are held in suspension waiting their turn in the multi-choice queue. Digital abundance creates buffer zones as well as turbulence, pockets of delay, holding patterns.

Here, I think it is useful to recall one of the early critics of this easy facility of achievement in computing. Jospeh Weizenbaum is noted as a computer scientist and famed for the Eliza program, the core conceptual work behind many of today's efforts towards natural language programs and also the grandmother of all chatbots:

‘Almost anyone with a reasonably orderly mind can become a fairly good programmer with just a little instruction and practice. And because programming is almost immediately rewarding, that is, because a computer very quickly begins to behave somewhat in the way the programmer intends it to, programming is very seductive.’ (1984: 277)

Are such programmers today’s freaks? The isolated shepherds of their data-flocks? It has become commonplace to identify Asperger’s Syndrome with hackers and programmers but these are the most recognisable examples of such drives. How many little numerical disorders exist in our habits? Stepping on the cracks in the pavement an equal number of times with each foot. Remembering numbers. Being in a couple. There are vast populations of numerical patternings running through the populations of our heads.

Weizenbaum goes on to note that the educational system is ideally structured, and present at a moment in a person’s life when they are easily enraptured and absorbed by such facility, usually without any fundamental questioning. Here we see the seductive power of arithmetico-material drives, the imaginal space they open up, especially in the fast, low friction world of computation, a world where one standard object acts upon another, acting upon another and another, in an infinitely seductive and rapidly changing infinite regress through layer upon layer from interface, through strata of code to circuits and beyond. Under digital abundance each generation of programmers is a processor cycle, the completion of a loop of instructions, more fuel for the explosion mapped by figures of perpetual geometric increase such as Moore’s Law. If, for Darwin, ‘death is the blind sculptor’ of geometric increase in life, what is it that provides friction, a test of fitness for arithmetico-material drives under conditions of digital abundance? In order to understand the aesthetics by which this sculptor or perspectivally-delimited artist operates, a politics of numbers and of the mechanisms of calculation and life is required. In other words, what are the nomograms that describe or synthesise contemporary arithmetico-material drives?

First of all, viruses and worms. One could almost transpose the glorious terms with which Marx describes his reading from the British Government's blue books of industrial statistics, mapping the growth of factory production, or his (by today's standards rather modest) tripping on the stock market, straight onto the tales of the massive escalation of viruses. 2003 saw the *Slammer* infect 75,000 servers in ten minutes; the *Blaster* worms followed for PCs; *Sobig.F* had, at one point nearly four percent of all email traffic as its vector of propogation. The various versions of *MyDoom*, at the beginning of 2004 took that to five percent. *Netsky.D* 'has broken the records for the speed at which it has spread, having infected over 200,000 computers within hours of its detection' (*New Scientist* 2004: 5).

It takes statistics, the creatures of the avalanche of numbers, to describe these plagues of logic. One can only experience them, as a user, at the interface of a PC, or as a systems administrator viewing internet traffic logs. That is to say that the perceptual tools available to understand and sense into the passage of viruses and the materiality of networks are limited. We are left with as much sense of things as a viewer of glitch art[4] - an accidental scalarly defined aperature into a process occurring outside of the interface we are assigned. A question is whether the position of the human or the user is a perspectival scale which is able actually to grasp such processes except as a kind of residue.[5]

Some projects, such as the *Human Cellular Automaton* or much of the catalogue of experiments compiled by socialfiction.org, work directly to make arithmetico-material drives palpable by moving software outside of the casing of the computer.[6] In another resource for such work *Crowds and Power* (1992 [1960]), Elias Canetti attempted to provide a typology of such cloudbursts of behaviour in urban crowds, with an emphasis on the abuse possible by their actors' at least partially unconscious involvement. As distributed and modularised patterns of behaviour and information become part of the general imaginary, the available repertoire of understood ways of doing things, we can begin to see self-aware and often wittily gratuitous conjugations of social forms and arithmetico-material

drives. Phenomena such as the wave of Flash Mobs generated in 2003 provide contexts in which a growing literacy in the open combination of loosely uniform behaviours (often directly working on pop-science concepts such as complexity and emergence) produce a palpably different consistency of interactions.

But let us recoup; scientific idealism, of which numericalisation is a form, achieves historical agency.[7] It works. As it does so, it gains the capacity to forge elements - at a certain scalar level - to a schema which enables them to reproduce the qualities and behaviours of ideal objects. (It is the reproduction of, not full conformity to, such schemas that is suggested here.) It does so by means of numbers and relations between them. This achievement - and it is a significant one, achieved in part by a massive determination to pay careful and comparable attention to the world - has however, two problems, or more accurately - openings: that of scalar perspectivalism, in which dimensions of relationality of an object are occluded or functionally shorn off; and the relative incapacity to describe non-metrical activity by the interaction of metrically defined parts, that is, the relation between intensity and extensity.

The context of software amplifies on a massive scale the condition of multiple layers of standard objects interacting at calculationally accelerated speeds, and which indeed provides the mechanism by which further arithmetico-material cloudbursts are engendered and delivered.

There is a small group of Perl poems by the artist and programmer Harwood, a member of the group Mongrel, that I think capture some of what it is to provide a nomogram, a sensorial device into these cloudbursts. Freaks of number, the paragons of the unnatural, condense calculational power into themselves, they boil days of computation by hand into a few seconds of technique and neurotic power. Arithmetico-material drives burst out of bodies, feed off them, turn them into fuel.

In *London.pl* a poem usefully annotated by Florian Cramer for the *Run_Me*

repository,[8] Harwood provides a means, through software, of sensing into these drives. If, for Hacking, the avalanche of numbers is a way of describing the birth of statistics and the gradual generation of a form of control based on the modulation of populations, here it is a means of reversing such a process and rebuilding part of the capacity of the bodies of those turned to fuel by capitalism and the arithmetico-material drives of industrialisation.

The poem is a rewrite, a plagiarism, of William Blake's 'London' (1791). Published in the book *Songs of Experience* in the last decade of the eighteenth century, this vivid burst of rage is only sixteen lines long, yet it manages to impress a profound set of sensations. The predominant sensorial impression is that of breaths, combined with political, economic and social violence, breaths as the marker of rancorous suffering life: cries, cries of fear, voices, bans or proclamations, cries of chimney-sweeping children, sighing soldiers wrecked by the wars between the competing imperiums of England and France, cursing harlots, and screaming babies. Blake makes a robust and defiant list of the ravages of society governed by access to the simultaneously abstract and brutally factual apparatus known as money. What is charter'd, isolateable as property, made 'proprietary' as the poem reversions it, is urban life.

In the hashed comments to the poem we see the following:

```
# NAME
# London - Simple Act Redress
# The American War was the last judgment on England.
# Inoculated against the sewer. Albion's Angels
# Rise up on wings of iron & steel, spreadsheet & rule:
# To gift sanitation & sulphurous fire to:
# The wheat of Europe,
# The rice of Asia,
# The potato of America,
# The maize of Africa.
# Massacre-bloated, angels crawl from the corpse of war.
# Five times fatter than when they entered.
```

Here, the systems of commodification, health standardisation via immunisation, and war are built upon the disastrous repression of the English revolution, the massacre of potential futures by the dictatorship of Cromwell, and the introduction of new energy sources to populations via the parasitical use of colonies. Spreadsheets and rulers, metrical systems are fuelled and changed by the capacities of metals and the populations working them.

In *London.pl*, Harwood takes statistics of average lung capacity, height, life-expectancy of particular ages and class populations in this era, turns them into a variable for a program to compute the volume, length and number of screams that such a number of such a typical set of sizes of lungs could produce. In the words of another text, 'pushing' the resulting quantity of air, 'through a speaker system in the waveform of a scream'.[9]

Screams in poetry are often the representatives of an unnameable thing, a burning kernel of anguish which represents the soul and is inaccessible to language. *London.pl* by contrast, sharing this with some of the work of Diamanda Galas on the plague of AIDS or the resolutely and rightly obscene monuments to the massacres in Rwanda, shows how much this screaming is caught up in systems of numericalisation and acceleration through the operations of calculus.

After making these calculations of numerically induced screaming, the poem, as a program then sets an output for the results: an as yet unwritten Perl module PublicAddressSystem.pm. The comments in the program read:

```
use PublicAddressSystem qw(Hampstead Westminster
                           Lambeth Chertsey);
# PublicAddressSystem is an I/O library for the manipulation
# of the Wheelen Vortex4 129db outside warning system.
#
# from Hampstead in the North, to Peckham in the South,
# from Bow in the East to Chertsey in the West.

# Find and calculate the gross lung-capacity of the children
```

```
# screaming from 1792 to the present calculate the air
# displacement needed to represent the public scream
# set PublicAddressSystem instance and transmit the output.
# to do this we approximate that there are 7452520 or so
# faces that live in the charter'd streets of London.
# Found near where the charter'd Thames does flow.
```

The soot-encrusted burned skeletons of children are still lodged in the heads, the chimney stacks of London, the screaming is still going on. This poem, designed to be reversioned as an actually functioning program attached to a PA, provides a way in which two scales, at which this violence simultaneously occurs, can be sensed into and thought. At the level of a numerically recognisable 'fact', an account of voices disappeared from history, and at the level of an arithmetico-material drive, a way of understanding this process as systematic. Here, we are all freaks of number. Calculation machines are here built into bodies, lives are deleted, burnt up, expended, but they are also the means by which they can be understood and, like the calculation machines of D'Ocagne, turned to make accounts.

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NOTES:

1. Since writing this text, I note that a third edition, from 1928, is published in English, trans. J. Howlett and M.R. Williams, Charles Babbage Institute reprint series (1986), History of Computing, Cambridge, Mass.: MIT Press and Los Angeles: Tomash.

2. According to the page, 'Mathematicians of the African Diaspora' maintained by Dr. W. Scott Williams, Professor of Mathematics of SUNY, Buffalo, Tom Fuller died at the age of eighty in 1790 <http://www.math.buffalo.edu/mad/special/fuller_thomas_1710-1790.html>. Further brief speculation about Fuller can be found in, E.W. Scripture, 'Arithmetical Prodigies', American Journal of Psychology, vol.4, no.1. April 1891. A more developed survey of mathematical prodigies of the period, and giving further information about many of the people cited by d'Ocagne is, Frank D. Mitchell, 'Mathematical Prodigies', American Journal of Psychology, vol. 18, no.1, April 1907.
Both papers can be found on the same page on memory techniques, games, card sharping and magic tricks maintained by Oleg Stepanov at <http://users.lk.net/~stepanov/mnemo/>.

3. A useful survey of electronic portraiture, including a number of uses of facial morphing and computer-generated personalities is given in a lecture by Jasia Reichardt at the Tate Gallery site <http://www.tate.org.uk/audiovideo/wnmwn/live_wnmwn.htm#reichardt>.

4. Glitch Art <http://www.beflix.com/index.html>.

5. See, for two texts clarifying scalar perception, Edwin A. Abbott, Flatland: a Romance of Many Dimensions, Dover Publications, and Ret Marut aka B. Traven (1981) 'The Scarf', in To The Honourable Miss S and Other Stories, Sanday: Lawrence Hill.

6. A performance script from 1999 which has participants acting as a cell in a Game of Life; also see <http://www.socialfiction.org>.

7. Though of course, not all, or even most scientific idealisms do so: the notorious example is that of Lysenko, documented in detail in Lecourt's A Proletarian Science? (1977).

8. See <http://www.runme.org/project/+londonpl/>.

9. See Lungs at <http://www.scotoma.org/notes/index.cgi?Lungs>.

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'Internet Havoc', New Scientist, 6 March 2004.