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THE MONIAC  
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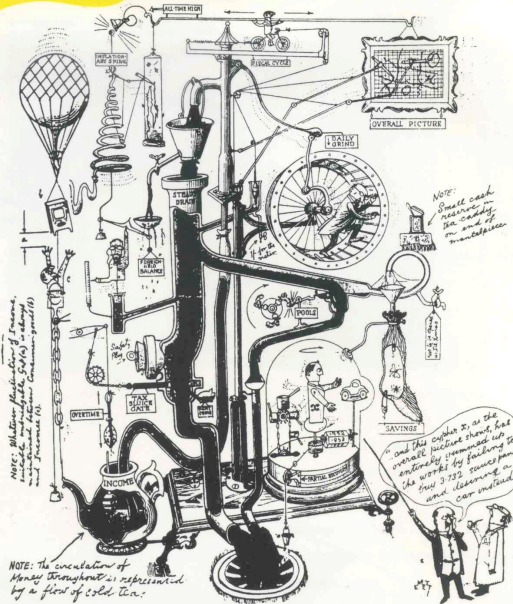
NZIER

**COMPAQ**

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KIWI INGENUITY  
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The Moniac is an ingenious mechanical economic model made up of pumps, pipes and spare parts, designed to demonstrate the interrelationship between various macroeconomic concepts in a national economy. This startling machine was invented by New Zealand economist Professor Bill Phillips at the London School of Economics (LSE) in 1949.

In 1987, restoration work began on one of two Moniacs stored in the basement of the LSE for over 20 years. Compaq Computer New Zealand Ltd, the Lotteries Board and the New Zealand Institute of Economic Research have financed the restoration of the second machine, and it has been shipped to New Zealand for permanent display.



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Punch's impression of the Moniac, April 1953  
(reproduced courtesy of Punch magazine)



The restored Moniac has been shipped to New Zealand for permanent display

Says Ian Penman, Managing Director, Compaq Computer New Zealand Ltd, "After ten successful years producing the computer industry's most technologically advanced hardware, Compaq is pleased to recognise technological excellence in other spheres. Compaq Computer New Zealand Ltd is proud to be associated with the remarkable creation of New Zealand's greatest economist."

"I am particularly pleased that it has been possible to restore one of Professor Phillips' Moniac machines and have it brought to New Zealand," said Dr A.E. Bollard, Director, NZIER. "It is part of our historical heritage. The Moniac typifies Kiwi imagination, ingenuity, perseverance, craftsmanship and excellence."

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T H E M O N I A C  
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◆ Professor Phillips' Moniac has had a chequered history. Indeed, if it hadn't been for Bill Phillips' interest in both macroeconomics and hydro-dynamics, it's unlikely that it would ever have been built at all.

As a student at the London School of Economics, Phillips found the fashionable Keynesian theory hard going, and decided to fall back on his engineering training to help him understand better. He saw that money stocks could be represented by tanks of water and monetary flows by water circulating between these tanks through pipes, and began drawing up plans for a prototype machine in 1949.

He met with little encouragement from his tutors, although no machine capable of explaining the complex workings of the economy with any degree of accuracy had been built at the time. However Phillips persevered, largely thanks to encouragement from his friend Walter Newlyn, later Professor of Development Economics at Leeds University, who organised a grant, and the far-sighted support of Nobel Prize-winning Professor James Meade. Meade once described the shock of learned professors on "being interrupted by a wild man from New Zealand waving blue prints in one hand and a queer shaped piece of perspex in the other."

Using an amazing array of bits and pieces (including windscreen wiper motors from a Lancaster bomber) Phillips eventually managed to construct the first Moniac in his garage workshop in Croydon, South London.



On 29 November 1949 the Moniac was unveiled at the economics faculty seminar. To the amazement of the audience - many of whom had come expecting a fiasco - the Heath Robinson-like contraption worked. Pacing up and down, chain-smoking and outlining Keynesian theory in a heavy New Zealand drawl, Phillips explained how his machine could be used to demonstrate the inter-relationship between various macroeconomic concepts such as consumption, taxation, import/export ratios and interest and exchange rates.

In time, further machines were produced. With Meade, Phillips demonstrated how two machines could be linked together, each representing a different economy. With the machines operating in tandem, Phillips showed the economic effects of one economy's performance on another's.

For a while the Moniac captured the public imagination. In April 1953 Punch published a humorous article on the machine, calling it a Financephalograph and suggesting that there should be one installed in every city, town or village throughout the country. "Using coloured water for money (an inconvenience denied the man in the street)," it wrote, "the machine reacts

obediently to every morsel of economic information communicated to it, and records, with its mechanical pens on its calibrated charts, the subtle impact of a slump in the second-hand ship market, the slightest hint of a boom in soap, emery-wheels or white fish."

Accompanying the article was a cartoon impression of the machine drawn by Rowland Emmett. The circular flow of money was represented by cold tea and the machine featured such ingenious devices as a mouldy sock to store consumer savings and a piggy bank for the economy's bent coins.

Punch may have laughed, but the world's economists were impressed. Shortly after the first demonstration, Moniacs were sold to both Oxford and Cambridge Universities as well as those in Birmingham, Manchester and Melbourne. Further Moniacs were sold to Harvard, the Ford Motor Company and even the Central Bank of Guatemala.

Work continued on the Moniac (the name was coined by Phillips' American agent to suggest money, an early computer called the ENIAC and something maniacal) into the early 1950s, but the advent of digital computers meant that the machine wasn't the commercial success it might have been. Colleagues at the LSE continued using the machine as a teaching device, but eventually even Phillips tired of going to the rescue of colleagues whose classrooms were flooded by temperamental machines and filled with giggling students. The LSE machines therefore stopped being used by the late 1950s.



PROFESSOR BILL PHILLIPS

◆ Professor A.W.H. "Bill" Phillips was perhaps New Zealand's best known economist. Born the son of a New Zealand dairy farmer on 18 November 1914, he left school early to live in Australia where his itinerant nature led him into a number of jobs including managing a cinema and hunting crocodiles.

In 1937 he travelled on the Trans-Siberian express via China and Russia to Britain where he worked as an electrical engineer. During the Second World War he served in the RAF Technical Branch until he was captured by the Japanese in Java and imprisoned in a POW camp. In 1946 he was awarded an MBE for his war service.

After the war Phillips worked with the County of London Electricity Supply Company, before taking up a New Zealand rehabilitation grant to study sociology at the London School of Economics. He soon became more interested in economics than sociology, and, encouraged by fellow students, he began to use his knowledge of

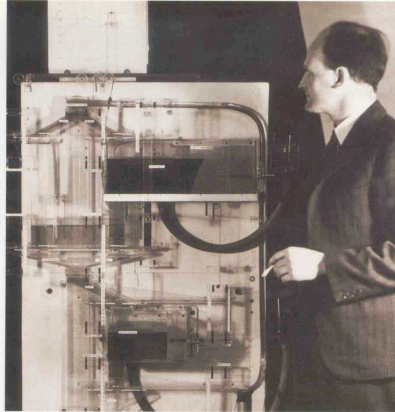
hydrodynamics to construct the first Moniac. Despite being greeted with widespread scepticism the machine worked, and in 1950 Phillips was offered a lectureship at the LSE.

In 1958 Phillips published a highly-regarded article linking inflation and unemployment. As well as forming the basis of his famous Phillips Curve theory, this article laid the foundations

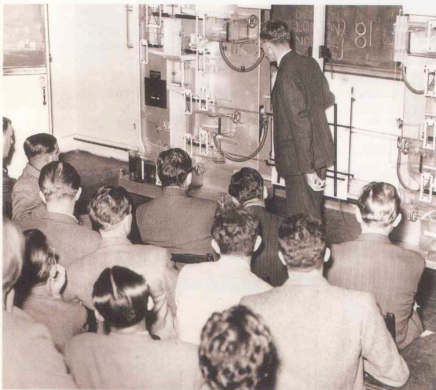
of the study of wage inflation for the next three decades and led to the development of rational expectations theory. He continued his work on practical economic modelling, working with the early electronic analogue computers with particular reference to macroeconomic modelling.

Also in 1958 Phillips became Tooke Professor of Economics at the LSE, a position he held until 1967, when he moved to Australia to be closer to his family. There he was appointed Professor of Economics at the Australian National University in Canberra.

The last years of Professor Phillips' life were spent with his wife Valda at their home in St. Heliers, Auckland. Professor Phillips died suddenly on 4 March 1975. According to those who knew Professor Phillips he was always absurdly modest about his major contributions to post-war economics.



◆ Professor Phillips with one of the original machines 1950 (reproduced courtesy of the London School of Economics and Political Science)



◆ Professor James Meade using two linked Moniacs to simulate the workings of international economic relationships (reproduced courtesy of London School of Economics and Political Science)

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HOW IT WORKS

◆ Despite its bizarre appearance, the Moniac provides a remarkably accurate picture of the workings of an economy. Built several decades before today's powerful computer-based economic models, Phillips' machine produces comparable results.

Using a complicated series of pumps, sluices, valves and pulleys, Phillips' Moniac traces the circular flow of money through the economy. These flows are controlled by nine adjustable "functions", each of which regulates a set of macroeconomic relationships:

Income and Taxation

Income and Government Expenditure

Income and Consumption

Interest Rates and Savings

Interest Rates and Investment

Domestic Expenditure and Imports

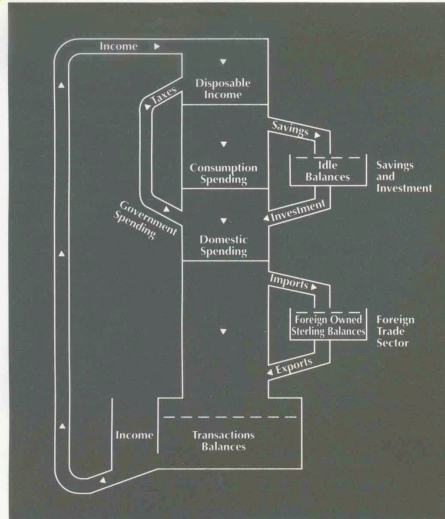
Domestic Expenditure and Exports

Exchange Rates and Imports

Exchange Rates and Exports

These functions are arbitrary in that they represent government, business or consumer behaviour.

A bottom tank holds a stock of water representing total national income. From this tank the "dollars" are pumped to the top of the machine, where they are distributed in different



A simplified view of the Moniac

quantities (determined by the "functions") among taxes, consumer expenditure and savings. How the remaining money flows through the economy depends upon the volume of government expenditure, the translation of savings into investment, and the propensity of consumers to spend, particularly on imports.

As the money is pumped through the economy the water levels change in the various tanks, activating controls, demonstrating the interdependence of macroeconomic concepts and

ultimately guiding mechanical pens on calibrated scales for a hard copy print-out. (In Emmett's cartoon the pens are engaged in a game of noughts and crosses.)

Phillips' hydraulic model answers many of the most fundamental economic questions: How effective is monetary policy? What is the impact of high interest rates on investment? Can the government boost national income by increasing its expenditure? Do tax cuts increase domestic demand and employment, or is extra disposable income spent on imports? And what impact do changes in the exchange rates have on imports and exports?

COMPAQ

THE RESERVE BANK OF NEW ZEALAND'S MODEL XII

◆ Phillips' Moniac machine may have been the first successful economic model, but it is certainly not the last. Nor is it any longer the most powerful. Since Professor Phillips set the standard by which later mechanical economic models have been judged, there has been a succession of powerful models to help economists, government and management make policy decisions.

The role of Phillips' Moniac has largely been overtaken by computers - some computer-based models can run several hundred economic variables compared to the Moniac's nine. For example, Model XII is the latest in a line of econometric models of the New Zealand economy developed over the past twenty years by the Reserve Bank of New Zealand. This model uses 105 equations to describe facets of the



Model XII running on an advanced COMPAQ notebook personal computer

economy and includes behavioural equations derived using co-integration techniques. Model XII reflects the changes in economic relationships emerging in the post-1984 deregulated environment.

The New Zealand Institute of Economic Research has transferred Model XII to a personal computer using Lotus 1-2-3 as the simulation software. At the launch of the restored Moniac, visitors will be able to see Model XII running on an advanced COMPAQ personal computer and compare its performance with Professor Phillips' predecessor.



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