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THE Department of Experimental Psychology has recently presented the Museum with a set of historic instruments previously in use there. The twenty-three instruments range in date and type from the mahogany and brass Hipp Chronoscope (Peyer and Favarger, Switzerland, c. 1900, shown above, top left) used to measure reaction time, to an early example of a modular digital computer, the Oxford Modular Programming System (BRD Electronics, England, 1969).

Some of the instruments are unique objects built expressly for specific experiments. Others are common, mass-produced items intended mainly for student laboratories. Functionally, most would have been used in the type of psychological experiment broadly defined as the 'stimulus response' test – either they provide a sensory stimulus or a stimulus in the form of a task, or they are devices used to record various forms of a subject's response. For recording or measuring a subject's reaction, they include mechanical, electrical, and electronic versions of pen recorders, as well as instruments to measure psycho-physiological variables such as electrical charge in the skin or changes in blood flow.

Experimental psychology began at Oxford in a clandestine laboratory with William McDougall (1871-1938), a successful and controversial British psychologist. McDougall's *Introduction to Social Psychology*, first published in 1908 and going through twenty-nine editions, was a standard textbook for many years. He also wrote a respected book on abnormal psychology, which grew out of his work as a physician for the army where he treated cases of war-related mental illness during World War I.

McDougall developed an interpretative framework which he called 'hormic psychology', from the Greek root meaning 'impulse'. According to this theory, behaviour is understood in terms of the instinct or 'native propensity' of a species. The theory is often compared to Freud's hedonist (or first) theory of psychology in which behaviour is understood in terms of another instinctual pattern: the attainment of pleasure and the avoidance of pain.

McDougall came to Oxford in 1904 to fill the post of Wilde Reader in Mental Philosophy. The post was established in 1898 to facilitate the study of all types of mental phenomena, but its terms explicitly forbade conducting experimental research to this end. McDougall, however, firmly believed in the necessity of experimentation in psychology, and so with the help of two other Oxford physiologists, Francis Gotch and Charles Sherrington, he obtained a room in the basement of the Physiology Laboratory where he was known to conduct experiments 'after-hours'.

In the 'Department of Psycho-Physics', as the plaque on the door read, McDougall studied visual phenomena such as after-images and competing perspectives. Two of the instruments recently acquired are associated with this laboratory. The first is a mechanical kymograph made by C. F. Palmer. This instrument is a standard kymograph used for recording, consisting of a rotating vertical brass drum onto which a sheet of paper is pasted. Usually the paper was darkened by smoking, and to record events a stylus with some means of transducing a psycho-physiological change was positioned against the drum so that it scratched into the paper a trace perpendicular to its direction of rotation.

The second instrument is a McDougall-Schuster 'Dotter', which was invented by McDougall in about 1900 (shown above, top right). This device creates a task for subjects whereby they must draw lines connecting, avoiding or circling dots that are presented to them through a window which opens onto a section of a rotating disc of dotted paper (illustrated on page 5). The task is made more or less challenging by adjusting the speed of the rotating disc and the size of the window. This instrument was reproduced in different forms and used in experiments for nearly thirty years. The example now in the Museum is still in working order.

The dotting machine was used by McDougall to rate a subject's level of fatigue. It features in one notorious experiment which McDougall conducted with his colleague May Smith in about 1919 to test the effects of alcohol, opium, tea, and strychnine on fatigued mental states. The Medical Research Council, at the request of the Liquor Traffic Control Board, published the experiment. It became known not because of the results, but because McDougall and Smith were subjects as well as experimenters. The authors state in the report that self-experimentation was necessary due to a shortage of subjects during war-time, but this explanation did not do much to deter the negative attention provided by headlines such as '[Psychologists] Try Drugs on Themselves' (*New York Times*, October 25, 1920).

As with the kymograph and several other instruments in the collection, the dotting machine was made by C. F. Palmer. This firm was founded in London in 1891 by Charles Fielding Palmer (1864-1938), who started out as an engineer and bicycle manufacturer. The company described itself as a maker of "Research and Students' Apparatus for Physiology, Pharmacology, Psychology, Bacteriology, Phonetics, Botany, etc." and it was a prolific operation during the first half of the 20th century. The company made many instruments to order, including the Museum's dotting machine which was an early developmental prototype, as well as several instruments for Sherrington (many of which are currently on display in the Department of Physiology).

The other instruments by Palmer in the collection are two dual tracking devices used to assess eye-hand co-ordination; an electric recording drum; an ergograph used to measure muscular fatigue; and an induction coil with a variable interrupter for generating electrical stimuli. The stand for the Hipp Chronoscope by Peyer & Favarger may also be a replacement made by C. F. Palmer.

Throughout the rise in popularity of electronic sensing and recording instruments from the 1960s onward, Palmer maintained its standard production line of electromechanical instruments. Naturally, demand for these types of instruments fell and by 1987 the company was absorbed into the Harvard Apparatus Company.

The First World War caused a shortage of space in the University and around this time McDougall's lab space was taken over by the Royal Flying Corps. Not long after conducting his dotter experiments, McDougall left Oxford for Harvard University, believing that the situation at Harvard was more conducive to experimental psychology. This may have been true in general, but for McDougall his arrival in the States coincided with the end of his contributions to experimental psychology and a rapid shift in his reputation from leader to outsider.

Although McDougall strongly supported a functional approach to psychology, many of his ideas prevented his work from being integrated with the growing tide of American behaviourism led by J. B. Watson. The little experimental work he did do in America involved a generally discredited theory, Lamarck's theory of the inheritance of acquired characteristics, and the rest of the scientific community ignored it.

Evolution was an important element in McDougall's hormic psychology. Like Lamarck, McDougall viewed evolution as a process of increasing complexity and perfection. This view is evident in his eugenic theories of the intellectual superiority of European over all other races – and even of the British over the French. It is also clear in his opposition to interracial mixing, which he feared would 'probably result in the total destruction of all that humanity has striven and suffered for in its nobler efforts' (*The Group Mind*, Cambridge, 1920).

Such ideas were easily sensationalized and led to more attention by the *New York Times*, including a parody of his dystopian vision headlined 'The Coming Era of Vegetable Supremacy' (August 21, 1921), so that even outside the scientific community McDougall slid into infamy. He published books and articles for a general audience on a broad range of issues including religion, nationalism, science, morality, and parapsychology ('Ghosts Do Exist, Admits McDougall' (December 4, 1926)). In 1927 he left Harvard for Duke University where he spent the rest of his academic career.

Meanwhile, back in Oxford, McDougall's first student, William Brown (1881-1952), became the next Wilde Reader in Mental Philosophy. From this position he continued gathering support for experimental psychology. In 1929 he first proposed to the University that a laboratory for psychology should be built, but it was not until 1936, over thirty years after its covert beginnings, that the Institute of Experimental Psychology, with Brown as the Director, was officially constituted.

A few of the instruments that date from this period were designed and built by Kenneth Craik (1914-45), the Cambridge psychologist who is considered a pioneer in the sensory sciences and in the field of cybernetics. These instruments were probably brought to Oxford when Craik was conducting experiments on vision with Oliver Zangwell, a founding member of the Institute of Experimental Psychology.

Craik's career in psychology was cut short when he was killed in a bicycle accident aged thirty-one. Since his death, his work has remained well received and his mechanical skills have become legendary. He designed and built many unique instruments, some of which are preserved and on display in the Experimental Psychology department in Cambridge. Colleagues recall that Craik 'would carry about with him a tobacco tin containing several small model steam engines that he had made, the smallest being truly minute' (M. V. Wilkes, *Memoirs of a Computer Pioneer*, 1985). Craik's mentor F. C. Bartlett described his work on a cockpit simulator as 'a very brilliant and beautiful application of calculating machine principles to a complex psychological problem'.

Craik's experimental focus was the sensory system, particularly visual perception. Much of his work involved the concept that the visual system has a sliding operating range, where, for example, the sensations of light and dark are relative to a certain baseline illumination to which the eye has become adapted.

One of the instruments amongst the Museum's new acquisitions was designed and built by Craik for studies such as these. Called a 'scotopic', or 'night' photometer, it is used to quantify the brightness of a surface in low lighting conditions. Shown bottom left in the picture on the previous page, it consists of a wooden box with several apertures: one to point at the surface to be measured, two eyepieces to look into the box, and one window onto a scale that will indicate the brightness (in foot candles). Brightness is determined when the user, looking into the eyepiece, sees the light from the surface presented via a mirror next to a comparison light from a bulb inside the box. The user must then adjust the brightness of the comparison light by turning a dial, which also affects the scale, to match the brightness of the surface presented next to it.

World War II dominated the short span of Craik's career in psychology, and most of his work had practical military applications. The studies with the photometer in dark-ground illumination, for example, were used to develop better means of detecting enemy aircraft by gunners. He was involved in a number of projects related to the optimization of information display in the cockpit, and he is credited with establishing several basic principles of radar display.

Another instrument in the Experimental Psychology collection that is directly related to Craik's work for the war effort is the 'Control of Velocity', or 'Pursuit Rotor', testing instrument that Craik invented in about 1939 for the military to use in screening fighter pilots. In this test the subject must use a steering wheel to direct a pointer so that it either hits or misses metal dots on a rotating wooden drum. The Museum also has a different model of the same test that was built by Richmond Electronics circa 1965-85.

Craik also applied calculating machine principles in his theoretical work. His central idea was that thinking must involve neural mechanisms that create symbolic models of external reality that can be used to plan actions, predict the outcome of events, and so on. This symbolic or computational approach became the dominant theory of cognition over thirty years later when the advent of digital computers and artificial intelligence re-shaped the landscape of the cognitive sciences.

The instruments in the collection from Craik's time onward reflect this change. Instruments from the 1960s include a volumetric pressure transducer (Grass Instruments, USA, 1960) and a psycho-galvanometer (Electronic Developments, England, c. 1969) both of which translate analogue biological variables into digital signals. These would be used in conjunction with instruments such as the 8-channel digital event recorder (BRD Electronics, England, 1970) and the 'Oxford' Modular Programming System (BRD Electronics, England, 1969). Psychological laboratories are not unique in becoming dominated by digital equipment from the 1960s onward. However, in the case of psychology, this new technology not only changed the way specific experiments were performed but had a profound affect on the fundamental nature of the research being undertaken, transforming the very objects under study.

As well as significantly enhancing the Museum's representation of the history of science in Oxford and of the biological sciences in particular, the collection from the Department of Experimental Psychology improves the Museum's holdings of 20th-century instruments and thus provides an impetus to investigate the many fertile and relatively unexplored range of issues affecting them.

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