P.G Department of Psychology

EMERGING RESEARCH AREAS IN NEUROPSYCHOLOGY

Course-CC-6 (Neuropsychology) Unit 1;
Sem 2

By
Dr. Priyanka Kumari
Assistant Professor
Institute of Psychological Research and Service
Patna University
Contact No-7654991023, E-mail- Priyankakumari1483@yahoo.com

EMERGING RESEARCH AREAS IN NEUROPSYCHOLOGY

A number of modern developments have contributed to the emergence of neuropsychology as a distinct scientific discipline:

- Neurosurgery;
- Psychometrics (the science of measuring human mental abilities) and statistical analysis;
- Technological advances

Neurosurgery

- Wilder Penfield and Herbert Jasper, pioneers in brain surgery, have provided a brief but informative history of neurosurgery. Anthropologists have found evidence of brain surgery dating to prehistoric times: Neolithic skulls that show postsurgical healing have been found in Europe. Similar skulls were left by the early Incas of Peru. It is likely that these early peoples found surgery to have a beneficial effect, perhaps by reducing pressure within the skull when an injured brain began to swell up. Hippocrates gave written directions for **trephining** (cutting a circular hole in the skull) on the side of the head opposite the site of an injury as a means of therapeutic intervention to relieve pressure from a swelling brain.

- Between the thirteenth and nineteenth centuries, a number of attempts were documented, some of which were quite successful, to relieve various symptoms with surgery. The **modern era** in neurosurgery began with the introduction of **antisepsis, anaesthesia, and the principle of localization of function.**

- In the 1880s, a number of surgeons reported success with operations for the treatment of brain abscesses, tumours, and epilepsy-producing scars.

- Horsley-Clarke “stereotaxic device” was developed for holding the head in a fixed position. This device immobilizes the head by means of bars placed in the ear canals and under the front teeth.

- A brain atlas is then used to localize areas in the brain for surgery. Local anaesthetic procedures were developed so that the patient could remain awake during surgery and contribute to the success of the operation by providing information about the effects of localized brain stimulation.

- The development of neurosurgery as a practical solution to some types of brain abnormality in humans had an enormous influence on neuropsychology.

- In animal research, the tissue-removal, or lesion, technique became one of the most important sources of information about brain–behaviour relations.

- Research on the human brain, however, was minimal. Most information came from patients with relatively poorly defined lesions—blood-vessel damage that included the brainstem, as well as the cortex, or brain-trauma lesions that were diffuse and irregular. And human patients often lived for years after injury; so histological localization (localization of structures on a microscopic level) was not possible. Neurosurgery provided a serendipitous solution. The surgical removal of cortical tissue in humans was as localized as the tissue removal in animal experiments. The surgeon would draw a map of the lesion, sometimes after stimulating the surrounding tissue electrically to discover the exact extent of the damages. As a result, good correlations were obtained between focal lesions in the brain and the changes in behaviour that resulted from the lesions.

- Information about behaviour obtained from patients who have undergone surgery is very useful for diagnosing the causes of problems in other patients. For example, if tissue removal in the temporal lobes is found to be related to subsequent memory problems, then people who develop memory problems might also have injury or disease of the temporal lobes.

Psychometrics and Statistical Evaluation

- The first experiments to measure individual differences in psychological function were made by an astronomer, Friedrich Wilhelm Bessel, in 1796. Bessel began a study of reaction time and found quite large variations among people. Individual differences were very much a part of Gall and Spurzheim's phrenology but, unlike their idea of localization of function, this aspect of their research attracted little interest.

- Charles Darwin's cousin Francis Galton (1822–1911) maintained a laboratory in London in the 1880s, where he gave subjects three pennies to allow him to measure their physical features, perceptions, and reaction times with the goal of finding individual differences that could explain why some people were superior in ability to others.

- Galton's elegant innovation was to apply the statistical methods of Adolphe Quetelet (1796–1874), a Belgian statistician, to his results and so rank his subjects on a frequency distribution, the so-called bell-shaped curve (a graphical representation showing that some people perform exceptionally well, some perform exceptionally poorly, and most fall somewhere in between on almost every factor measured). This innovation was essential for the development of modern psychological tests. It seems fitting that Galton's work was directed to describing individual differences, because Darwin's evolutionary theory of natural selection required that individual differences exist. To Galton's surprise, the perceptual and reaction time differences that he measured did not distinguish between the people he was predisposed to think were average and those he thought were eminent.

- In 1904, the minister of public instruction commissioned Binet to develop tests to identify retarded children so that they could be singled out for special instruction In collaboration with Theodore Simon, Binet produced what is now known as the 1905 Binet-Simon scale, designed to evaluate judgment, comprehension, and reason, which Binet thought were essential features of intelligence. The tests were derived empirically by administering questions to 50 normal 3- to 11-year-old children and some mentally retarded children and adults.
- The scale was revised in 1908; unsatisfactory tests were deleted, new tests were added, and the student population was increased to 300 children aged 3 to 13 years. From the tests, a **mental level** was calculated, a score attained by 80% to 90% of normal children of a particular age. In 1916, Lewis Terman in the United States produced a version of the Stanford-Binet test in which the **intelligence quotient** (IQ)—mental age divided by chronological age times 100— was first used. He set the average intelligence level to equal IQ 100. Hebb first gave IQ tests to brain-damaged people in Montreal, Canada, in 1940, with the resultant surprising discovery that lesions in the frontal lobes— since Gall's time considered the centre of highest intelligence—did not decrease IQ scores. Lesions to other main areas not formerly thought to be implicated in "intelligence" did reduce IQ scores. This counterintuitive finding revealed the utility of such tests for assessing the location of brain damage and effectively created a bond of common interest between neurology and psychology.

- Many of the clever innovations used for assessing brain function in various patient populations are strongly influenced by intelligence-testing methodology. The tests are brief, easily and objectively scored, and standardized with the use of statistical procedures. In addition, neuropsychologists use the IQ test to assess patients' general level of competence; many other tests that they administer are IQ-like in that they are rapidly administered paper and- pencil tests. Although certain applications of "mental testing" are liable to criticism, even harsh critics concede that such tests have appropriate uses in neuropsychology. In turn, mental tests are continually being modified in light of new advances in neuropsychology.

Advances in Technology

- An important current area of technological advance is brain imaging, of which there are a variety of methods. All of them take advantage of the ability of computers to reconstruct images of the brain. The images describe regional differences in structure or function, electrical activity, cell density, or chemical activity (such as the amount of glucose that a cell is using or the amount of oxygen that it is consuming). Whereas once the neurologist and the psychologist administered time-consuming batteries of tests to patients to locate the site of brain injury, brain-imaging techniques quickly provide a picture of the brain and the injury. The use of such techniques does not mean that neurologists and neuropsychologists are no longer needed. Individual assessments of patients are still required for treatment and research.

- Moreover, individual brains can be surprisingly different, and so it is difficult to predict what job a given brain region does for a given person. Brain-imaging methods are important in another way, too. Some imaging techniques can reveal changes in the brain at the very moment a task is being performed or learned or both.
- The imaging methods thus provide a new and extremely powerful research tool for investigating how the brain produces behaviour and changes with experience.