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Walter W G, Cooper R, Aldridge V J, McCallum W C & Winter A L. Contingent negative variation: an electric sign of sensorimotor association and expectancy in the human brain. *Nature* **203**:380-4, 1964.
[Burden Neurological Institute, Stapleton, Bristol, England]

The discovery of this component of the electrical activity of the brain opened the door to the use of event-related potentials in behavioural science and provided a powerful tool for investigating how the human brain prepares for action. [The *Science Citation Index*® (*SCI*®) and the *Social Sciences Citation Index*® (*SSCI*®) indicate that this paper has been cited in over 455 publications since 1964.]

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The discovery of contingent negative variation (CNV) was one of the many high points of 30 years of work by the late Grey Walter. The work was done at the Burden Neurological Institute in Bristol, England, a private research organisation specialising then, as it does now, in studying brain function by using the electroencephalogram (EEG). It is of some importance that the authors came from several disciplines. Walter was a physiologist; I was a physicist; Vivian Aldridge (now deceased), a radiologist; Cheyne McCallum, a psychologist; and Arthur Winter, an electroencephalographer. All the living authors are still working together at Burden—continuity in research is vital.

The technical and clinical developments in the late 1950s no doubt contributed a great deal to the discovery of CNV, but the prime factor was the persistence of Grey in pursuing ill-defined trails that others gave up for lost. The development of DC amplifiers by Frank Offner in the late 1950s, the design and construction of a two-channel evoked-response averager by W.J. Warren[1] (an engineer) at the institute, and the clinical use of intracerebral electrodes by H.J. Crow[2] (a neuropsychiatrist) at the institute provided us with the opportunity for studying the functioning brain in all its complexity, particularly the interaction of associated stimuli.

These conditioning experiments had recurred on numerous occasions since the 1930s, probably stimulated in the early days by Grey meeting Pavlov.

In 1962, a study was undertaken of a group of autistic children by using the EEG from scalp electrodes, and it was during this work that Grey first noticed a negative shift between the associated stimuli. At that time, we were using a time constant (low-frequency response) of 0.3 seconds because of the difficulty of recording from these disturbed children, but I remember clearly Grey coming out of his office and saying that we must do something about this negativity between S1 and S2. The answer, once the question had been put, was easy: lengthen the time constant. Fortunately, we had an eight-channel DC recorder generously given to Grey by Offner, and once this was done a clear negative shift was seen. The problem that remained was whether this activity was due to eye movement, and many and varied were the recordings taken during 1963 to clear up this point. The real proof came from the use of cortical electrodes that showed a small change. This was sufficient for Grey, and CNV was made public at a meeting of the EEG Society in 1964. A similar paper was given at a meeting of the American EEG Society in Santa Fe, where it was received with great acclaim. Publication in *Nature* was rapid, and CNV has rarely been out of the literature since that time (see reference 3 for a review).

It is important to note that CNV is not related to the characteristics of the stimuli themselves but to the use that the subject makes of them—a link to cognitive psychology that has been very valuable.

1. **Cooper R & Warren W J.** The use of Barrier Grid storage tubes type 9511A for extraction of average evoked responses from the e.e.g. *J. Physiol.—London* 157:38P, 1961.
2. **Crow H J, Cooper R & Phillips D G.** Progressive leucotomy. (Masserman J H, ed.) *Current psychiatric therapies*. New York: Grune & Stratton, 1963. Vol. III. p. 100-13.
3. **McCallum W C.** Potentials related to expectancy, preparation and motor activity. (Picton T W, ed.) *Human event-related potentials*. Elsevier. In press, 1985.