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Dear Steve,

Thank you for your additional figure which I think is better. The publisher has not yet reacted to our submission.

There are two questions regarding memory function and electrical activity. Is a seizure necessary for the alteration in memory function? To what extent does the electrode location modify the effects on memory, regardless of whether the current is seizure-inducing or subthreshold?

In our work with patients we have repeatedly found that the application of electrical current through electrodes which are either on one side or bitemporal, do not change the behavior of the subject, unless a seizure (convulsion) occurs. With subthreshold stimulation, improvement does not occur. In my early work we did check on memory changes and using very gross measures we did not find changes in memory function with subthreshold stimulation. In those days we were delighted because we did believe that improvement and memory changes went hand in hand. More recently, as we worked with unilateral electrode placement, and detailed memory tasks focussed on verbal and non-verbal, visual or auditory parameters, we did not specifically look for the effects of the subthreshold stimulation. With seizures induced through unilateral electrodes, we and others have found that memory changes do occur. The type and degree of memory change is directly related to the location of the electrodes. Thus, bitemporal electrode placement elicits greater changes in verbal and auditory memory tasks than any unilateral electrode placement. Electrodes over the non-dominant hemisphere usually elicit lesser degrees of memory interference, and these are focussed on non-verbal, visual tasks. If unilateral electrodes are placed over the dominant hemisphere, the changes in memory tasks are greater and more manifest on verbal, auditory type tasks. Lately, one of my coworkers has

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done a series of experiments with the electrodes bifrontally placed and showed that the memory changes are even less than the unilateral non-dominant. Unfortunately he did not do the specific tests to separate verbal from non-verbal aspects.

Thus, we would have to answer our questions that in man memory tasks are interfered with when seizures (convulsions) are produced and the type and degree of memory task interference is somehow related to electrode location.

My first question, whether a seizure is necessary for an alteration of memory function, does not find an answer in human literature to my knowledge. I know the controversy is real in the work that Jim and others have been doing. In your work, I would be particularly sensitive to some measures of current intensity and duration, electrode location, but also evidence for seizure (and its duration) and/or convulsion. From your letter it is not clear to me whether you can clearly parcel out the contribution of subthreshold and supra-threshold electric currents.

With regard to your last question, the evidence is quite clear that if electric currents are introduced over one side of the scalp, these may or may not cross contralaterally (as reflected by the development of convulsions or electric seizure activity) and this transfer depends directly on the amount of current delivered.

The accompanying note to all the participants in the conference will bring you up to date as to the status of our volume.

My best personal regards.

Sincerely yours,

Max Fink, M.D.
Executive Director

MF/ij
Enc.