How do we record and analyze HFOs? Micro vs. macro electrodes, automatic vs. visual analysis

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HFOs have been recorded with microelectrodes in experimental animals and in humans, and with a variety of sizes of macroelectrodes primarily in humans, as well as with scalp electrodes and MEG. Given the large difference in scale between these recordings, one can reasonably ask if we are talking about the same phenomena: the event recorded by a microelectrode covers too small a surface to be recorded by an intracranial EEG electrode and *a fortiori* by a scalp electrode. Does a macro-event, recorded with a clinical intracranial or a scalp electrode, represent the "sum" of many synchronized local micro-events? If this is the case, we should study the mechanisms by which such small micro-events are synchronized. Or is it not necessary for micro-events to be synchronized to still generate events at a macro-scale? We would like to propose a mechanism by which non-synchronized micro events can nevertheless add up to a macro-event.

The question of whether we should use automatic analysis, visual analysis or computer-assisted semi-automatic analysis is also a complex one. The answer will depend on the context: experimental studies have usually relied on automatic analysis in part because of the high signal to noise ratio of intracerebral microelectrodes; are there drawbacks to this approach? What are the risks for human studies, which have often relied on semi-automatic or visual analyses, to move to automatic analysis?