

Key:

P: Dr. Pustilnik

P: Judges evaluating new neuro technologies can bring to bear the same frameworks they've always used for evaluating evidence, particularly scientific evidence. Even though this form of evidence is new, the emphasis should be on the three Rs, relevance, reliability, and risk of prejudice. There are some new differences in emerging neuro technologies that I'll talk about. But first, I want to talk about the ways that these are very similar to other kinds of expert evidence. First of all, new neuroscience through various modalities, whether functional magnetic resonance imaging, or EEG or others, seems so technologically advanced that it suggests it may solve almost all of our problems about how people behave or what they think. In fact, some kinds of brain-based evidence may not be relevant to the issue under consideration. The first and most important, perhaps the most difficult determination that a judge would have to make is, does this type of evidence give the trier of fact some meaningfully new and different evidence that will help them determine the question under consideration? The second issue is reliability. Unlike in the forensic sciences, particularly DNA, there is no standardization for how to produce different kinds of brain images, functional magnetic resonance imaging, diffusion tensor imaging, EEG, other forms of brain measurement technologies that may be forthcoming, like near infrared detection of pain level, are all done differently by different investigators in different laboratories and may even vary depending on the types of machine settings they use. It's important before this type of evidence is admitted into court that judges and experts themselves understand whether the offered evidence has been done with a suitable degree of scientific rigor, meeting accepted methodologies. One of the most difficult challenges is that as these fields are so young, there aren't known and accepted error rates and base rates of particular conditions. At some future point, I hope that it'll be possible to say that a particular type of image means to a particular degree of confidence that some condition is or isn't present. At this point, it's not possible to say that as to any individual condition in most cases. I'll come back at the end to an important distinction though between individual uses of brain imaging evidence and group averaged uses. Third, is risk of prejudice. Risk of prejudice exists with any type of expert evidence that perhaps the jury will overvalue the evidence. With brain imaging evidence studies conducted by the MacArthur Foundation and other entities have indicated that there may or may not be a higher degree of risk of prejudice than with other types of evidence. On the one hand, it seems so scientific and powerful and futuristic that we can look into the brain that some commentators have been concerned it will overwhelm the jury's own capacity to make their own decisions. On the other hand, empirical studies have indicated that jurors don't shut off their judgement function and are able to process this type of information.

Ultimately, I think that the risk of prejudice depends upon its relevance and its reliability. If it's highly relevant and highly reliable, then we would need to find an overwhelming risk of undue prejudice before that evidence should be excluded and that on the current evidence seems to be unlikely. A very important issue with the use of neuroscience evidence is this distinction between individualized uses and group average uses. For example, does this plaintiff have level seven pain in his knee versus does this plaintiff have the type of brain image that in 75% of cases indicates a chronic pain condition? Currently, there are no well validated measures of brain imaging outputs for functional magnetic resonance imaging that could tell us very much about whether an individual is definitely in pain, whether he or she is or is not capable of a certain level of mature decision making. Whether he or she definitely is or is not addicted to drugs or whether he or she had some kind of consciousness of guilt or awareness of wrongfulness of their conduct. Instead, neuroscience can give us very powerful insights as to the overall or general patterns that we see in human brains that may relate to some of these functions and conditions. We may decide to make policy or make individual case decisions based on the knowledge that juvenile brains have some predictable differences from older brains or that the brains of people who have substance misuse disorders experience very different forms of reward salience and temporal discounting than those of people who are not subject to either being young or being addicted or some other condition we may be interested in. This could affect decisions that jurors make when they hear framework evidence, it could affect the ways that judges think about transfer from juvenile to adult court or sentencing or parole or opportunities for leniency or second chances. There's a great deal of power that's available in brain imaging for the law and for courts but not necessarily for solving any one case as to proving an individual person's abilities, disabilities, claims or lack thereof. In using neuroscience evidence, courts can draw on the forms of experience that they've developed over many years and that have been elaborated both in the federal rules and in Supreme Court cases, like *Daubert* and *Kumho Tire*. These should be very familiar to the judiciary and relate in particular to proffers of evidence that involve presentation of expert literature and synthesis of expert literature. A second type of expertise that courts will need to develop though will be new and that will relate to the evaluation of any imaging work or other brain specific work that has been done as to a particular party in the case. I'll take each of those in turn. When courts evaluate expert evidence that parties are offering drawn from the literature, courts are looking at whether the material has been peer reviewed, whether it meets general acceptance in its field, whether it's the product of reliable methodology applied to sufficient data. For neuroscience evidence, there are really no differences as between fMRI, EEG or other technologies that may emerge and the ways that courts have performed their gatekeeping role for all other forms of scientific and expert evidence. What will be very challenging though and what has been challenging so far, when it has arisen in court, is

when a party comes forward with a piece of brain-based evidence that makes a claim about the particular party, then courts have to ask the questions about whether this piece of expert evidence was produced in ways that are reliable. There isn't yet consensus in any field of neuroscience about what it would take to produce a reliable image that proves that a particular person does or doesn't have a certain level of maturity, was or was not affected in a particular way by their substance misuse disorder. In order to get to that place where individual images can be highly probative there need to be efforts toward standardization of protocols, training of researchers or technicians that perform these types of imaging workups or experiments and large enough sample sizes so that any particular brain image or other brain technology result can be evaluated as against a large enough sample population. In other words, we need to know error rates, base rates and other forms of instrument and lab and process standardization just as we would in any other field but new for neuroscience because it hasn't been done before. Several new technologies that have made their way into court already involve imaging what parties have argued are persistent features of their brains that cause them to be different or differently accountable and technologies relating to the way a person may have been affected by some incident in their life, like an accident that has caused them pain. A famous case, involving the penalty phase of a person who allegedly had psychopathic personality disorder, imaging was introduced, functional magnetic resonance imaging was introduced to show that this individual most likely suffered from psychopathic personality disorder. The imaging suggested that his emotional processing was simply different from birth than that of a typical person, in effect that he wasn't a monster but that he suffered from a birth defect that he came by in no culpable form. I can envision that evidence of this kind could be introduced increasingly in the future to suggest that responsibility may vary depending on a person's neurological capacity either to comprehend the consequences of their action or experience empathy with their victim or even to control their own behavior. But beyond the criminal context, one of the largest areas where people are driven into the legal system or otherwise may come to the legal system involve claims of pain on disability. Disability and pain are amongst the most significant reasons that people come into court. And some parties have attempted to introduce evidence that their brain activation shows that they are in pain and that their brain activation shows that their brain functions have changed in ways that are consistent with chronic pain. As this form of imaging becomes more sophisticated and or as more forms of imaging can provide evidence of pain or lack of pain, it's foreseeable that both plaintiffs and defendants and possibly claimants in disability will offer this kind of evidence. It's also foreseeable to me that people who either are or who alleged that they are affected by post-traumatic stress disorder may bring in imaging work to support their claim. Another arena where imaging work may be coming into court has to do with degree of developmental immaturity. Developmental maturity is a core argument both in the criminal and civil

systems. In the case of the Boston Marathon bomber, Dzhokhar Tsarnaev, experts were on call for testifying and possibly producing images as to whether his brain had sufficient maturity for him to comprehend his actions. I want to be clear though, a brain image can't show maturity or ability to comprehend actions, a brain image can show the degree to which a person's pre frontal cortex is developed and the extent to which it's connected to other relevant brain regions by white matter tracks. The person's subjective comprehension needs to be assessed in other ways because we can't always make a reverse inference from biology to behavior. Something that courts haven't seen yet that we may see in the future has to do with consumer devices. Many companies are starting to enter the brain space. There's a kind of a gold rush to create devices that interact with our neurology or neurobiology in one way or another. One of the first to commercialize is called the Muse headband, you wear it around your head and it's supposedly a dry EEG monitor that detects brainwave activity. This isn't a plug for the product, I don't know how well it works but it's foreseeable to me that data from these brain wave reading devices or other brain-based devices could be used in a couple of ways. First of all, there could be product's liability suits, my brain stimulation device that was supposed to help me consolidate memory faster actually caused my personality changes. And then the brain-based device would itself be the subject of litigation. Another potentially foreseeable use of brain-based devices in the court would be as a source of data. There have already been some cases where people's Fitbits or fitness trackers have proven or disproven their claim about where they were or what they were doing at the time in question. As brain-based devices become potentially more common, perhaps they too will become a source of evidence in civil and criminal cases.