PASSIVE INFRARED HEMOENCEPHALOGRAPHY (pIR HEG), INFRARED IMAGING of the PREFRONTAL CORTEX, and OTHER EASY WAYS to MONITOR PHYSIOLOGICAL RESPONSES and PHYSIOLOGICAL CHANGE.

AAPB WEBINAR

07/18/2025

1:00 to 2:30 PM EST

TODAY'S FORMAT

- 4 SECTIONS
  - pIR HEG (followed by 5 minute Q/A)
  - Infrared Imaging (followed by 5 minute Q/A)
  - Easy and inexpensive ways to monitor progress
  - Q/A for the remaining time

WHAT WE KNOW ABOUT THE BRAIN

- We know a great deal about what makes the brain malfunction. This includes anatomical lesions, major biochemical shifts, and severe emotional stressors.

WHAT WE KNOW ABOUT THE BRAIN

- We know less about how the brain actually works. A lot less! Knowledge about how the brain actually works changes daily.

WHAT WE KNOW ABOUT THE BRAIN

- Behavioral brain interventions are based on theoretical models that seek to explain brain behavior. These models are based on our relatively week understanding of how the brain actually works.
- Be humble in your assumptions about how the brain works!!!!

pIR HEG HEADSET

pIR HEG

- The design and use of pIR HEG is based on the assumption that the prefrontal cortex is an important part of the management of most brain functions. This is especially true for the management of the rate and magnitude of arousal.
- The assumptions don’t go much beyond that.

pIR HEG

- What is it? It is a means of monitoring prefrontal cortical brain activity through the forehead without requiring an electrical connection.
- It measures Infrared Radiation from the head in the frequency range of 7 to 14 microns.
- Note: The wavelengths for Visible light are much shorter, in the range of .75 micron (red) to .38 micron (violet).

pIR HEG

- The process involves using a movie to simulate real world emotional events and in doing so it stimulates responses from the limbic system.
- The limbic systems and the prefrontal cortex tend to work in a reciprocal pattern. Stimulating one inhibits activity in the other.

pIR HEG movie

- Here is one I personally like. Why? I’m not sure, but I really like it.

pIR HEG movie
Fellowship of the Ring

pIR HEG movie

- The movie has a purpose. It isn't primarily a reinforcer although that is part of it. It is mostly a dynamic stimulus, carefully selected for relevance.
- Movie directors are very good at jerking around emotions.
- When a stimulus evokes a strong emotion, the PFC goes offline – as it is supposed to.
- The client then has to mentally reverse that process.

WHERE DOES PIR HEG FIT IN THE OVERALL SCHEME OF FEEDBACK?

- **Peripheral biofeedback** (such as hand warming). The assumption (possibly not valid) is that it is training the autonomic nervous system more than the central nervous system.
- Brain biofeedback (also called neurofeedback). The assumption is that it is training the Central Nervous System.
  - EEG biofeedback (electron based neurofeedback)
  - HEG biofeedback (photon based neurofeedback)
    - nIRS HEG sends a visible red and near infrared signal into the brain and measures what comes back out.
    - pIR HEG is totally passive. It monitors a 7 to 14 micron infrared signal coming from the brain.

HEG neurofeedback

HEG neurofeedback (hemoencephalography) is **photon** based brain biofeedback. No skin prep required! Compared to EEG, it is immune to eye roll artifacts, and easily targets the prefrontal cortex. There are two kinds of HEG. **nir HEG** and **pIR HEG**.

Near Infrared (nir) HEG was invented by Hershel Toomin in 1994. (1916 – 2011)

Passive Infrared (pIR) HEG was invented by me in 1998. It is what I use exclusively in my office, mostly because I focus on the prefrontal cortex.

Peripheral biofeedback

Peripheral biofeedback **appears** to directly train the autonomic nervous system, but does so by incorporating the CNS, so it is also neurofeedback (brain biofeedback). You may be more familiar with peripheral feedback. It includes, finger temperature training, muscle tension training, skin conductance, and general relaxation techniques.

Peripheral biofeedback is a time honored tradition, that effectively treats various disorders based on assumptions **that are often not correct.** Example: Migraines were once thought to be primarily a vascular disorder. Now known to be much more complex. But warming the fingers still helps.

Relaxation training biofeedback

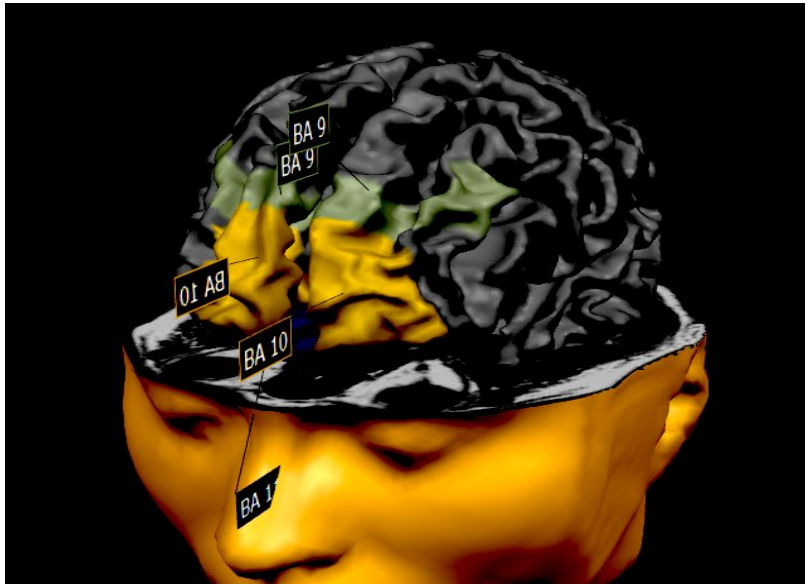
Early peripheral biofeedback was often directed at training a relaxation response within the frame of reference of folks like Benson and Jacobson.

I used to do a lot of relaxation training. Now I don't. In spite of seeming to be an innocent procedure, relaxation training can backfire because it also quiets the frontal management system. It removes the protective mechanism of mild tension, sometimes resulting in panic.

The common element of most bio/neuro feedback systems is teaching control of physiological responses. Problems usually are not caused by frontal lobe dysfunction although they can be. However most can be managed by training the prefrontal cortex to be more dominant. It also improves peak performance.

HUMAN FRONTAL LOBES

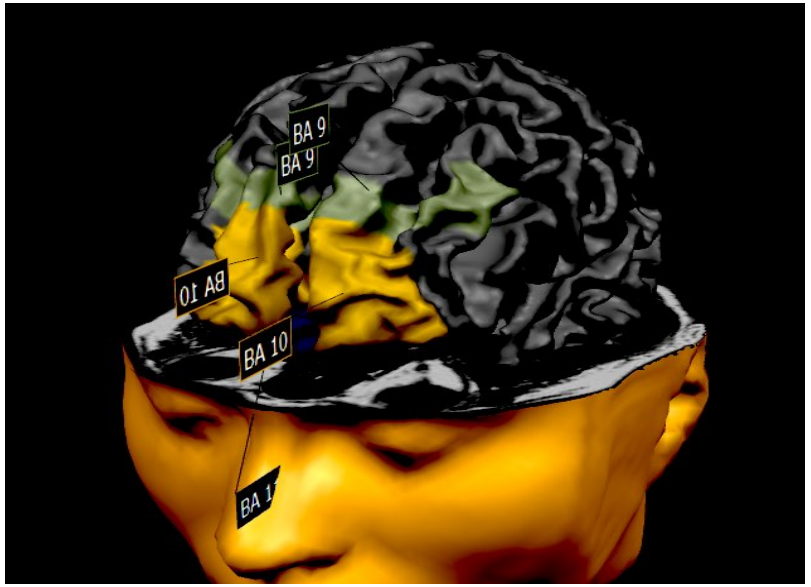
- The frontal lobes, especially the prefrontal region are a big deal! They account for a great deal of brain management.



HUMAN FRONTAL LOBES

(they are also quirky)

- This is the part of the brain that reflects the most recent evolutionary development. Because of that, it has the most "software bugs" (Hershel Toomim, 2009)
- Because of its location, it is easily injured.
- It is **supposed to shut down** easily during emergencies, permitting fight/flight response.



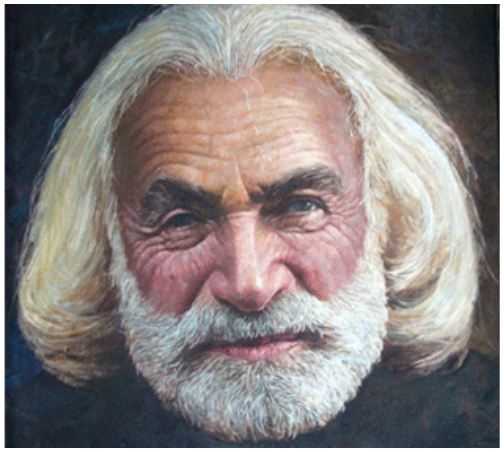
HUMAN FRONTAL LOBES

- Chopping off a chicken's head.
- Human frontal lobe is to the rest of the human brain as the chicken's brain is to the rest of the chicken's body.

50,000 YEARS!!!

- THE HUMAN BRAIN WAS DESIGNED FOR AN ENVIRONMENT THAT EXISTED 50,000 YEARS AGO
- ADAPTATION TO MODERN LIFE IS ACCIDENTAL

Karl Pribram



02/25/1919 – 01/19/2015

- Karl was one of the premier neurosurgeons in the US. He spent much of his early work defining the anatomical boundaries of the limbic system. He later altered his views on how the brain works in favor of a more external (holographic) perspective.
- My dissertation was based on his EEG based theory of “mental effort”. My current work on training Prefrontal Cortical Dominance is also based on this theory of “mental effort”.
- pIR HEG is based on PFC dominance developed through “mental effort”.

TYPICAL CLINICAL SYMPTOMS

In humans, most dominant clinical symptoms can be viewed as a **response that is a mismatch to the social environment**.

Physiological feedback is a way to retrain these response patterns.

TYPICAL CLINICAL SYMPTOMS

Often human and other mammalian behavior response patterns are mutually exclusive. This can be troublesome, but can also be useful in inhibiting troublesome responses.

ANXIETY

- Anxiety is one of those emotions that tends to be incompatible with other emotions. It also tends to impair purposeful actions. It **shuts down** the prefrontal cortex.
- Sexual arousal can shut down anxiety (and anxiety can shut down sexual arousal).
- Assertive/aggressive behavior can shut down anxiety.
- Most purposeful actions can shut down anxiety.
- **Activating the prefrontal cortex can shut down anxiety.**

AGGRESSION

- Incompatible with anxiety
- Rage is self reinforcing (it feels a lot better than anxiety, and there is a tension release when it is over).

DEPRESSION

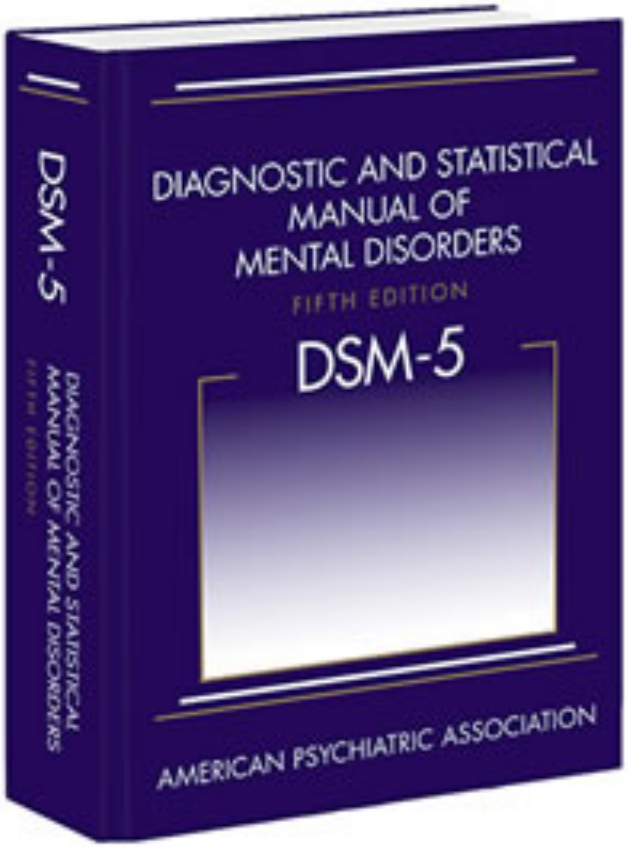
- As a brain mechanism it is a little bit unique and incompletely understood.
- In terms of brain activity, depression localizes itself as a low level of brain activity in the left prefrontal cortex in right handed left language lateralized individuals. This agrees with alpha asymmetry research.
- But what about folks who are reverse lateralized for language????

RECIPROCITY

- Planning and thinking inhibit excessive emotional responses. Emotions inhibit planning and thinking.
- One goes up, the other goes down.

DSM-5

- This is the American Psychiatric Association "bible" for classification of mental conditions.
- But, about 50% of the conditions listed represent the following:
- **EXCESSIVE RATE AND MAGNITUDE OF RESPONSE TO RELATIVELY BENIGN STIMULI**
- **If you remember nothing else today, remember that.**



PAROXYSMAL DISORDERS

SUDDEN ONSET, SHORT DURATION, QUICKLY LEAVING "EVENTS"
(rate and magnitude inhibited by frontal dominance)

- **These can be considered "mental" but may have heavy physiological underpinnings:**
- MIGRAINE HEADACHES
- SEIZURES
- RAGE REACTIONS
- PANIC ATTACKS

PAROXYSMAL DISORDERS

SUDDEN ONSET, SHORT DURATION, QUICKLY LEAVING “EVENTS”

These disorders don’t necessarily have their origin in the front of the brain, but frontal inhibiting functions can make it difficult for them to initiate, and limit the rate and magnitude of the event.

PAROXYSMAL DISORDERS

SUDDEN ONSET, SHORT DURATION, QUICKLY LEAVING “EVENTS”

When the PFC becomes dominant, paroxysmal disorders appear to be less frequent. They usually are not less frequent, but become “soft” enough to become difficult to detect.

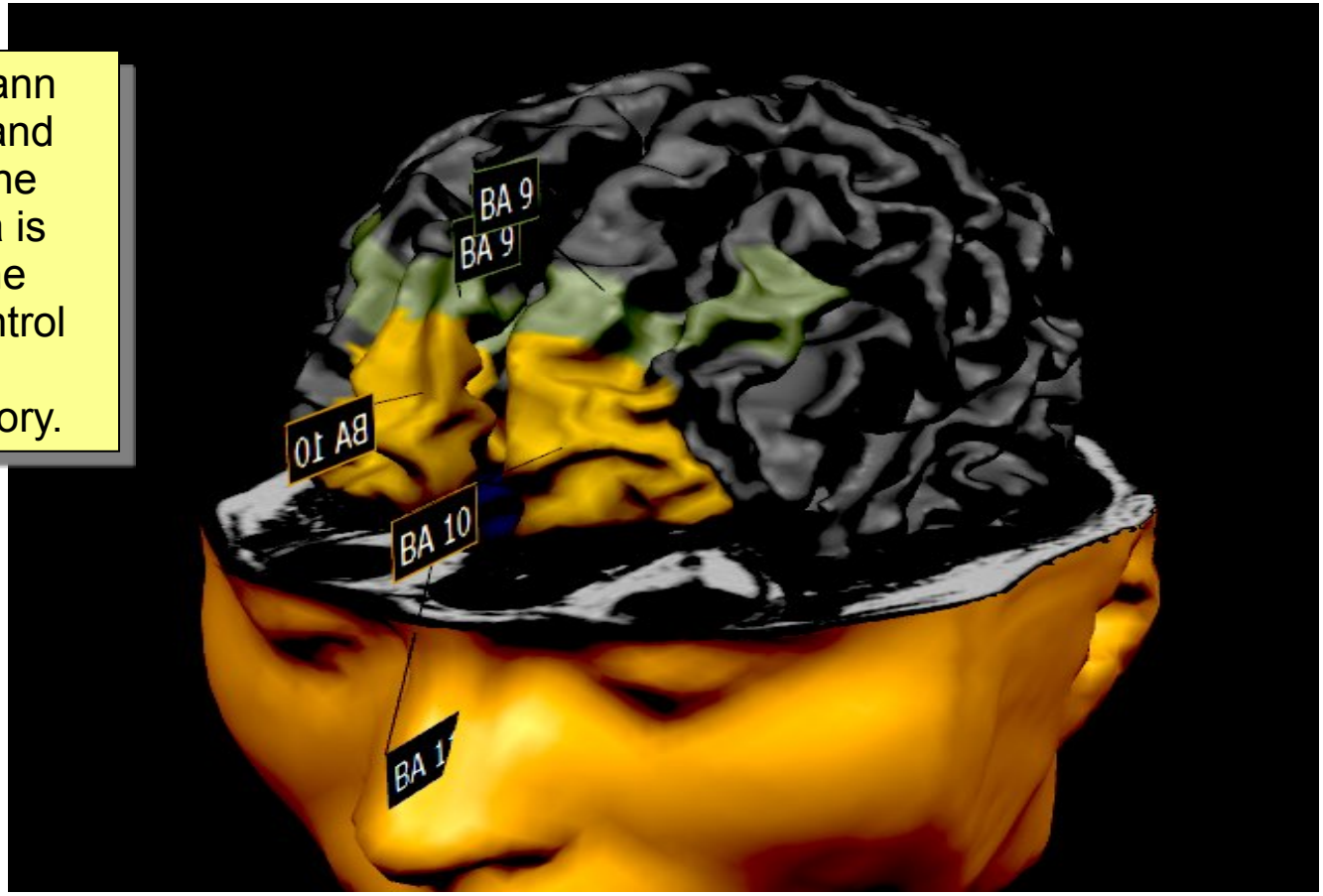
PAROXYSMAL DISORDERS

SUDDEN ONSET, SHORT DURATION, QUICKLY LEAVING "EVENTS"

pIR HEG seems to have a particularly positive effect on migraine headaches and other paroxysmal disorders when compared to non-paroxysmal disorders.

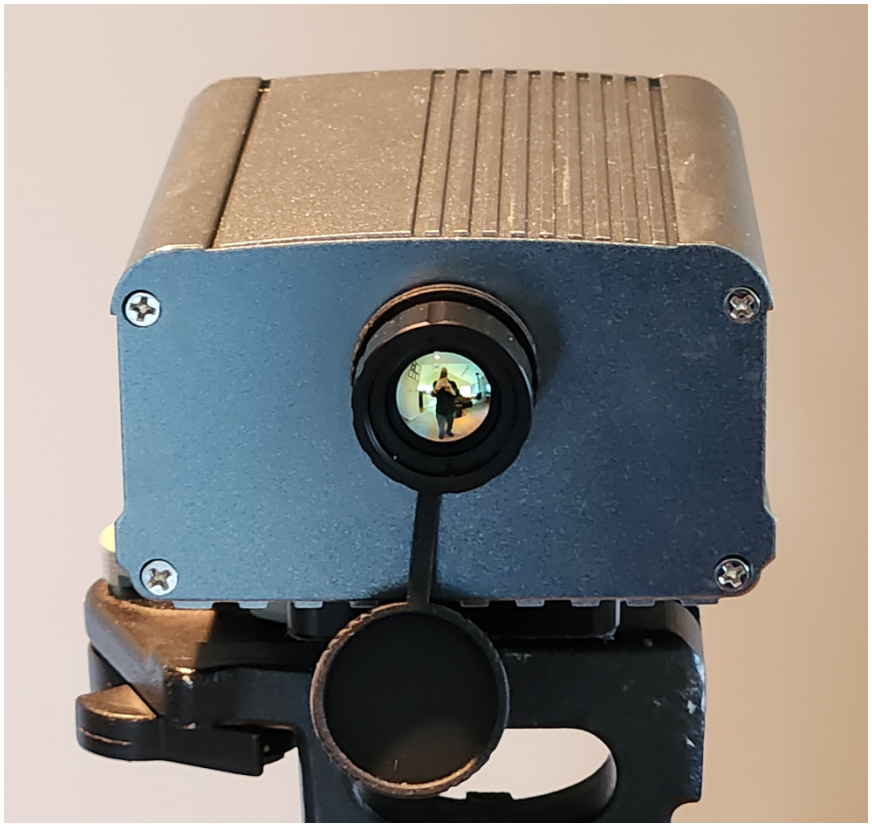
Behaviors that fit the previous descriptions tend to occur in the presence of relatively reduced dominance of the inhibiting circuitry of the prefrontal cortex.

Note: Brodmann areas 9, 10, and 11 make up the pfc. This area is considered the executive control center and is largely inhibitory.

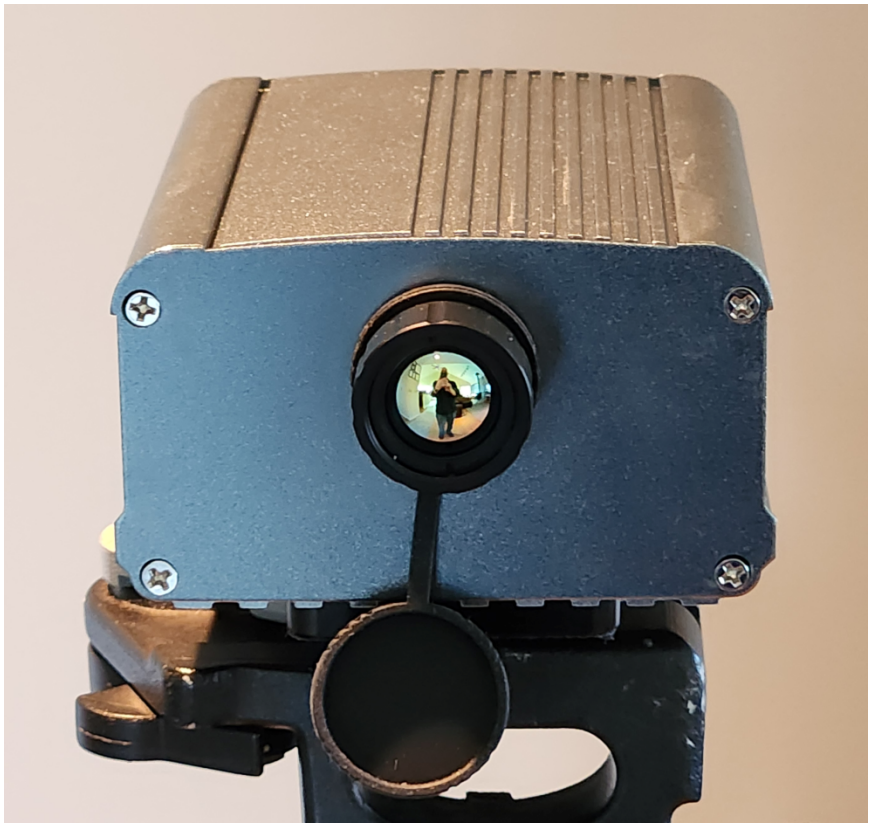


Q/A (5 MINUTES)
FOR MATERIAL COVERED SO FAR

Measuring change in PFC brain activity with…



AN INFRARED IMAGING CAMERA



SOME BRAIN MONITORING TECHNIQUES COMPARED

QEEG:

ADVANTAGES: Much more detailed and than Infrared Imaging. It also looks at the whole brain instead of just the front of the brain.

DISADVANTAGES: Time consuming. It may take up to an hour. Cost of administration time and possible cost of interpretation.

POTENTIAL RISKS: Small risk of injecting radio frequency signals from the processor that the wires are connected to. Very sensitive individuals may respond to those signals. Also the wires that are connected to the head, unless carefully shielded, can act as an antenna for all sorts of radio frequency transmissions and may act as a source of unintended brain stimulation.

SOME BRAIN MONITORING TECHNIQUES COMPARED

fMRI:

ADVANTAGES: Much more detailed than Infrared Imaging or QEEG. It may be more accurate than QEEG. It also looks at the whole brain instead of just the front of the brain.

DISADVANTAGES: Time consuming. It may take up to an hour. Cost of administration time and possible cost of interpretation are much higher than QEEG.

POTENTIAL RISKS: Most clinics use MRI machines that are either 1.5 or 3.0 Tesla in strength. These are generally considered safe, even for metallic stents. In research labs, the strengths available go up to 12 Tesla. At that level, the magnetic pull may have unintended impact on biological tissue. Metal stents and pacemakers can be significantly impacted. Even non ferrous stents can twist and get warm inside a powerful MRI.

SOME BRAIN MONITORING TECHNIQUES COMPARED

INFRARED IMAGING:

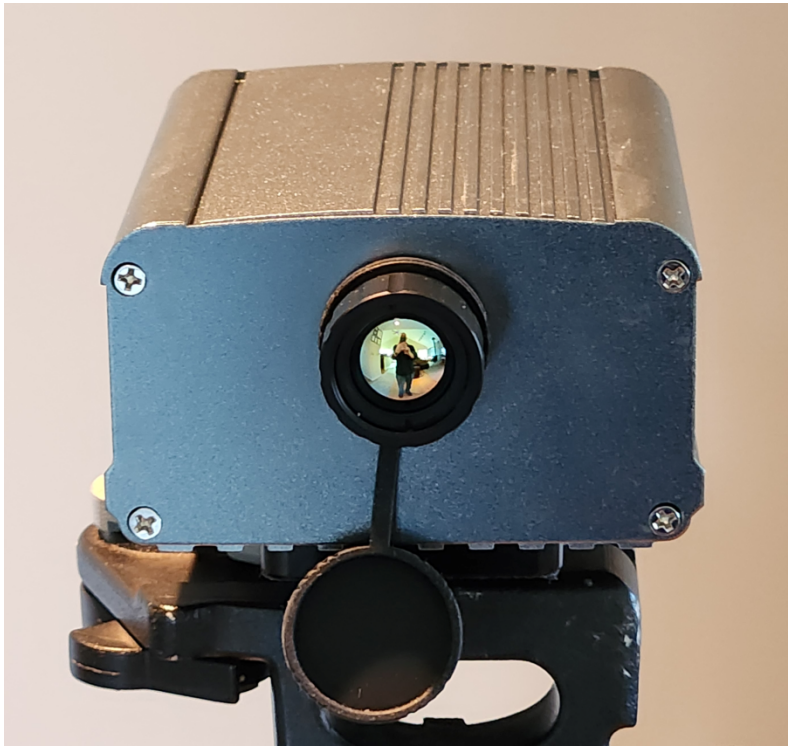
ADVANTAGES: Speed and cost. Image capture takes only seconds so images can be captured before and after every session, providing longitudinal data.

DISADVANTAGES: “Sees” brain activity only the front of the brain. Resolving power is less than QEEG or fMRI.

POTENTIAL RISKS: Over/under interpreting the images. Other than that, an Infrared Camera is totally passive, just like a regular camera, so it does not inject any kind of signal into the person. In that sense it is intrinsically safe.

INFRARED CAMERAS

- **This is the one that I currently use in my office. In an effort to keep costs down, I also manufacture it. I call it the Carmen Camera!**



INFRARED CAMERAS

- If you look carefully you will see my reflection in the lens. That is because Infrared Lenses are not made out of glass or plastic. Those materials (except HDPE) are opaque to 7 to 14 micron infrared. A good IR camera lens is made of germanium crystal and reflects visible light.

I was hoping these cell phone adapters would work out. Only $300 to $500. Nice images, but poor image repeatability. Not good for human work, or animal work.

INFRARED IMAGING ASSUMPTIONS

1. The human prefrontal cortex has wide ranging interactions with the rest of the brain.
2. The metabolic activity of the prefrontal cortex can be monitored with an infrared camera viewing the wavelengths between 7 and 14 microns.
3. The patterns of thermal activity emitted by the forehead correlate with behavioral characteristics and psychopathology.
4. Although these patterns may not always hold between people, they are meaningful for individuals over time.

VALIDITY

- I developed the use of infrared imaging of the prefrontal cortex in 2001. Since then I have personally evaluated over 36,000 infrared images.
- Others around the world have also collected infrared images. Current estimates are that clinicians have collected an additional 150,000 to 200,000 images.
- Although they are not yet organized into a comprehensive database, our observations of correlated behaviors are remarkably consistent.

Infrared Images measure radiated thermal energy in the 7 to 14 micron frequency spectrum. This is called “FAR INFRARED”.

Infrared images have no color so the computer inserts “false color”

COLOR CODE

LOW ENERGY **HIGH ENERGY**

FAR INFRARED ENERGY IS JUST HEAT

- **The consumer market is full of infrared products that will help you feel better, have better sex, live longer…**

- **Far infrared is really all just heat, like a hot water bottle or a hot bath.**

NEAR INFRARED ENERGY IS DIFFERENT. IT CAN BE TAILORED AS A BRAIN DIRECTED STIMULUS.

- **THROUGH VARIOUS TECHNOLOGIES, NIR STIMULI CAN DO SPECIFIC THINGS TO THE BRAIN.**

- **BUT… FAR INFRARED DEVICES ARE JUST HEAT.**

FAR INFRARED AND NEAR INFRARED AS A NOVEL FORM OF TREATMENT

- **FAR INFRARED IS “JUST HEAT”. STAND IN FRONT OF A FIREPLACE. HOT WATER BOTTLE.**
- **NEAR INFRARED INTERVENTIONS ARE TARGETED TO THE BRAIN. BUT IT IS MORE COMPLICATED THAN THAT.**

FAR INFRARED ENERGY IS JUST HEAT

- Applied heat can make you feel better or worse. It is not magic.
- If you have stiff, sore muscles, a hot bath may make you feel better.
- But
- If you have MS, it may make you feel worse, much worse. In pre-MRI days, one of the diagnostic tests for MS was to have the patient get in a tub of very warm water. Someone with MS may not be able to get back out without assistance because the ability to use skeletal muscles can weaken with higher temperatures.

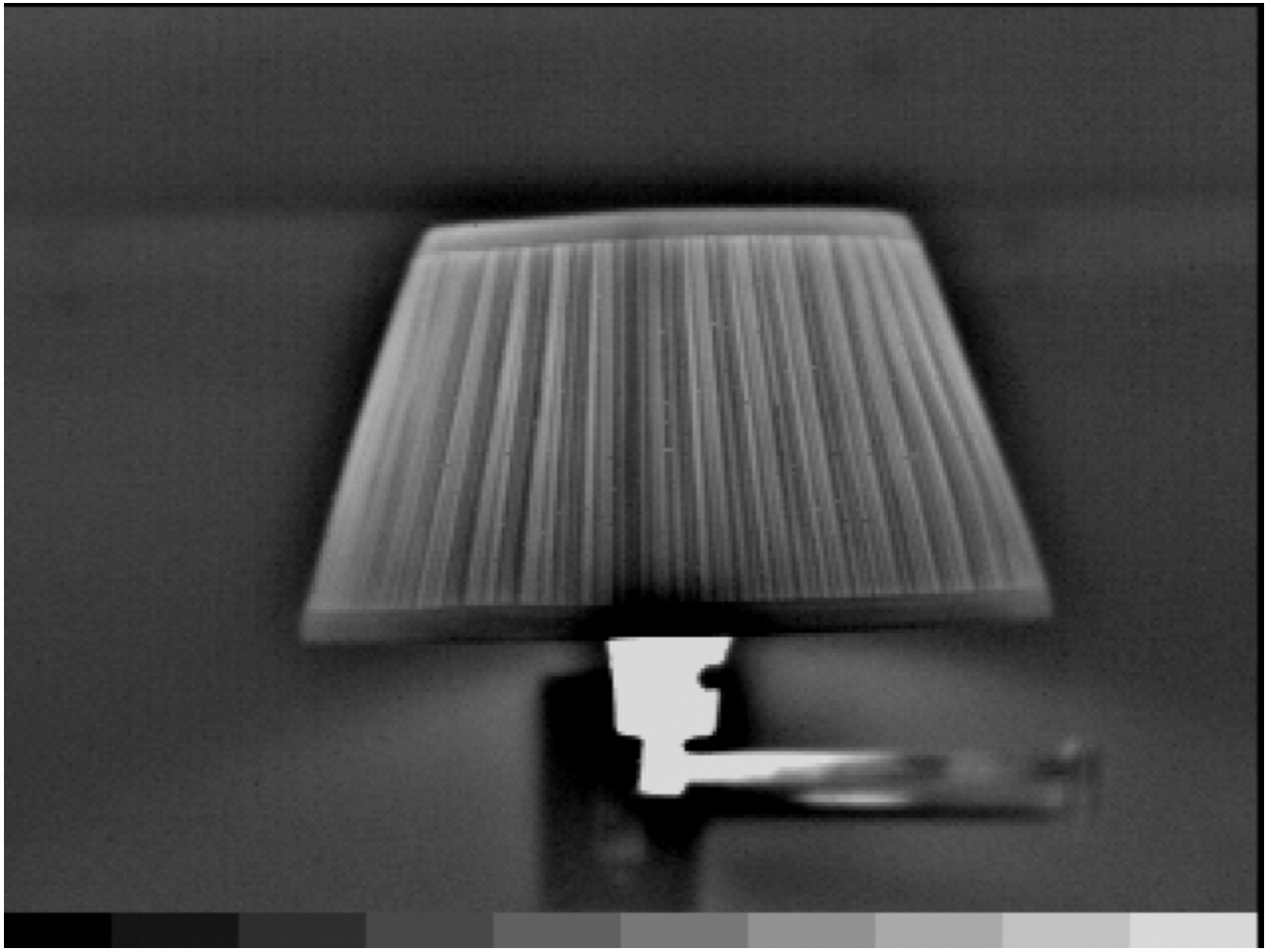
FAR INFRARED ENERGY IS JUST HEAT

- **It's also useful for finding food.**

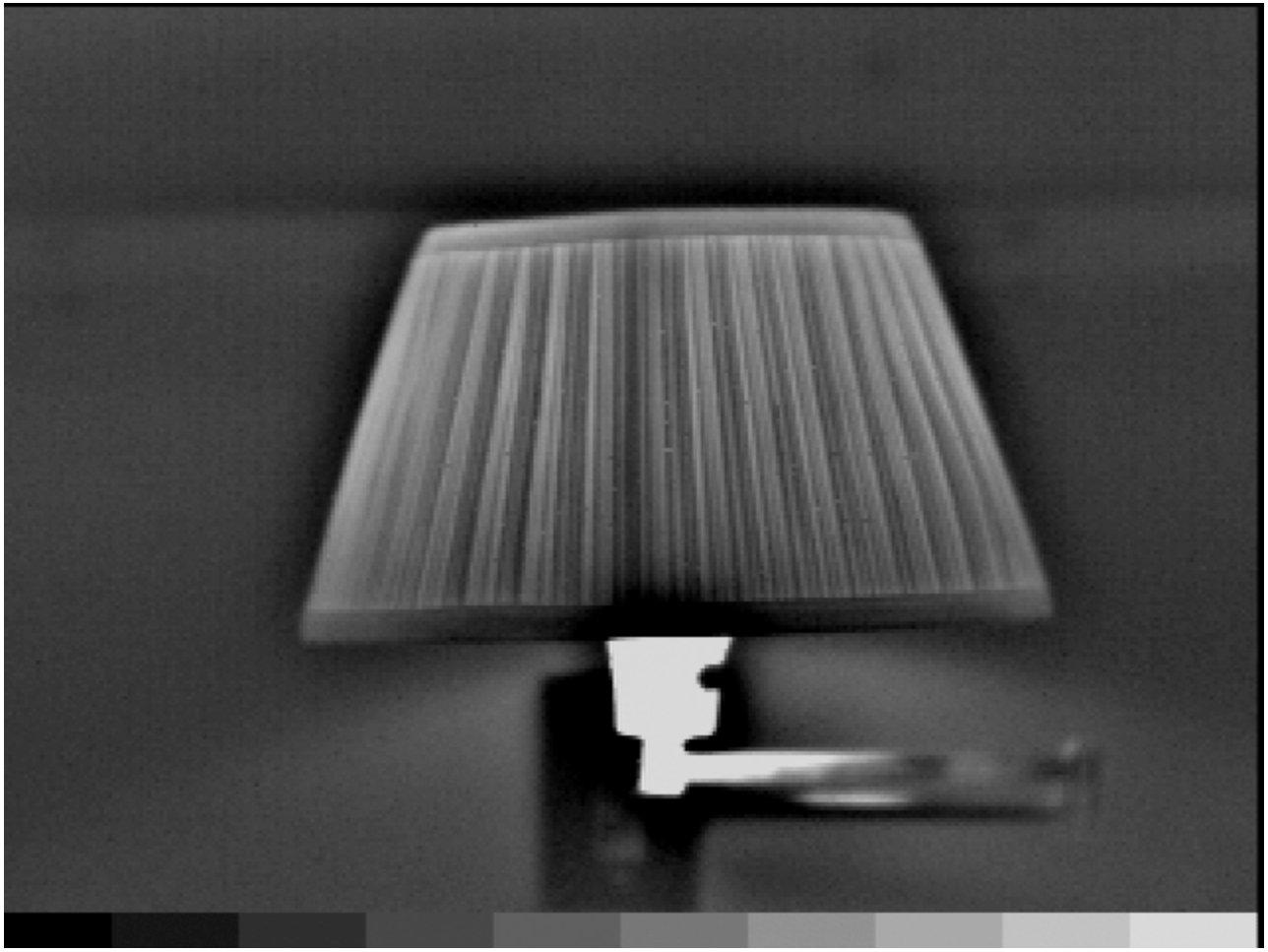
FAR INFRARED ENERGY IS JUST HEAT

- **And for finding people**

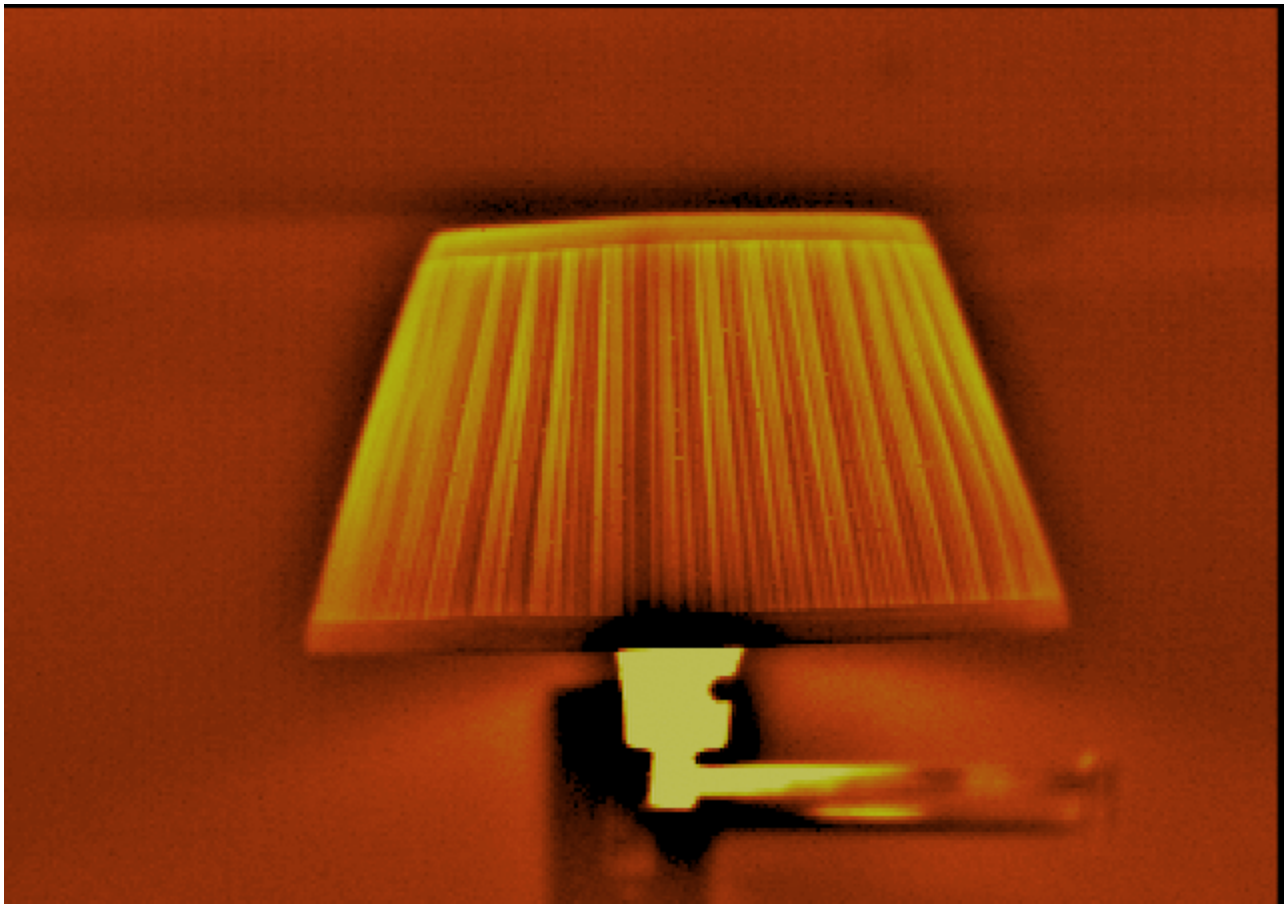
COLOR RESIDES IN VISIBLE LIGHT. INFRARED IMAGES HAVE NO COLOR.



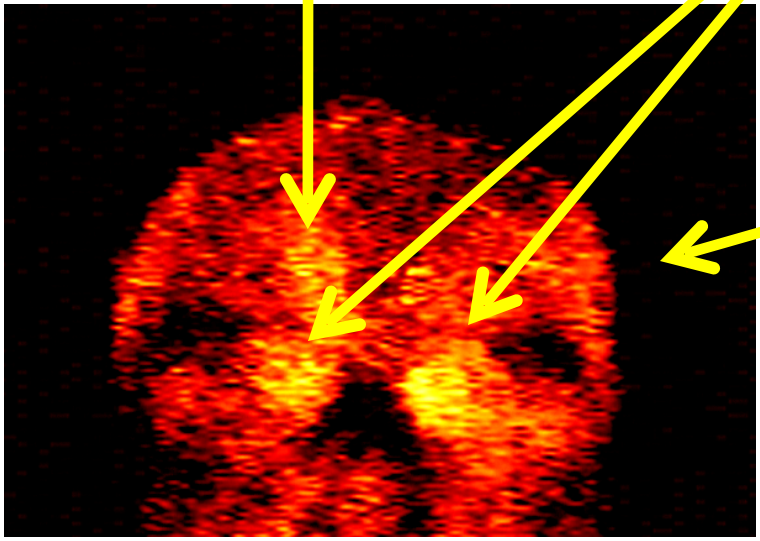
Incandescent Lampshade captured in grayscale



Computer generated "false color" of a grayscale image captured by an infrared camera.



The very first Infrared Camera I used was about 12 inches long and weighed about 15 pounds. The lens alone weighed about 10 pounds. The weight of the lens was actually its demise when the tripod was knocked over.



INTERPRETATION GUIDELINES FOR PREFRONTAL CORTICAL INFRARED IMAGES

- Generally, images with high variability in infrared activity (large range from low to high output) are found in people who have severe problems.
- Low variability is associated with more normal functioning.
- Progress is measured by improved behavioral measures and reduced variability in the infrared image.

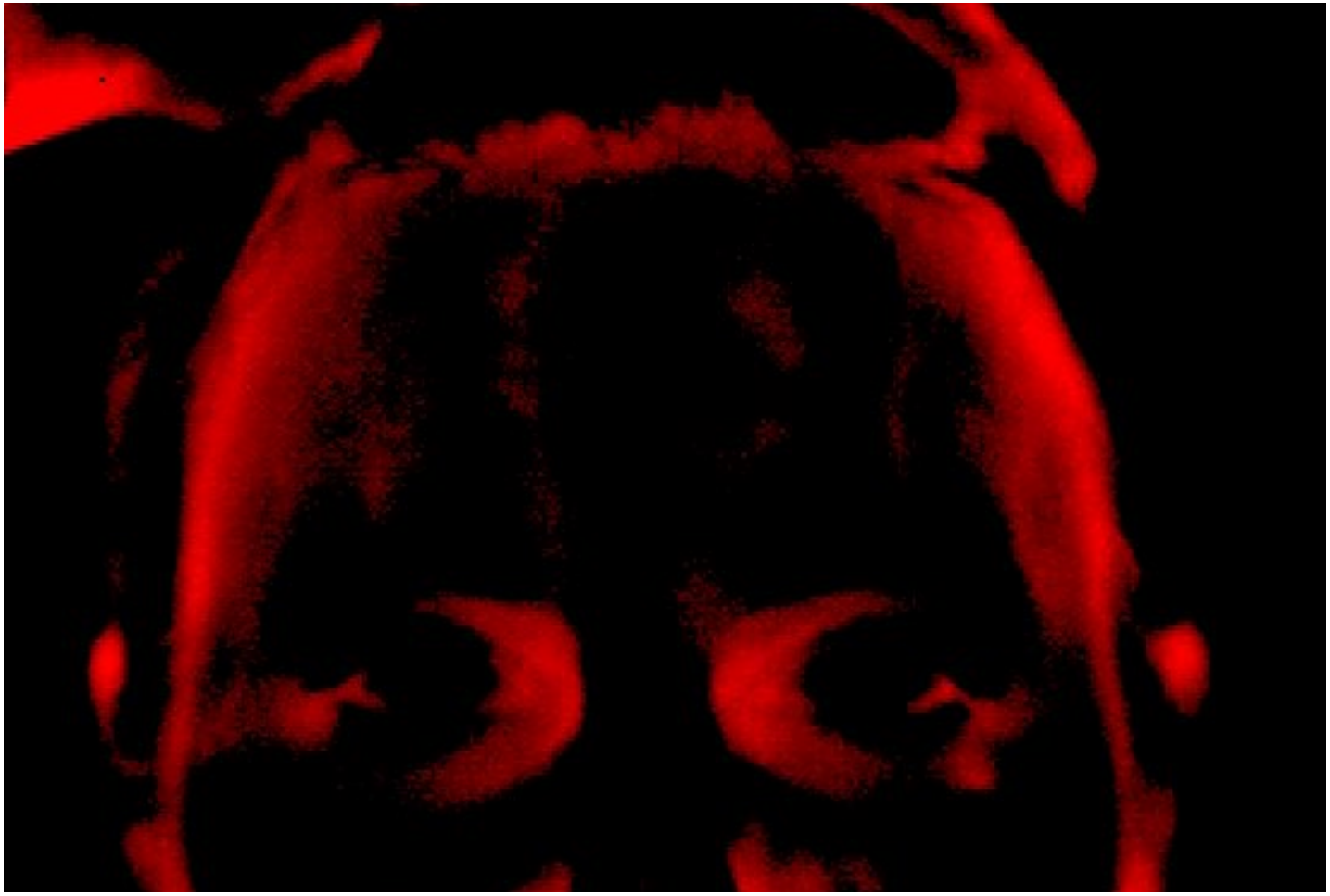
INTERPRETATION GUIDELINES FOR PREFRONTAL CORTICAL INFRARED IMAGES

- Laterality can be important. Depression, language, aggression, social insight, all tend to lateralize.
- Interestingly, anxiety does not lateralize, and is not directly observed on the infrared image.
- There are multiple patterns of attentional behavior that are clearly imaged.

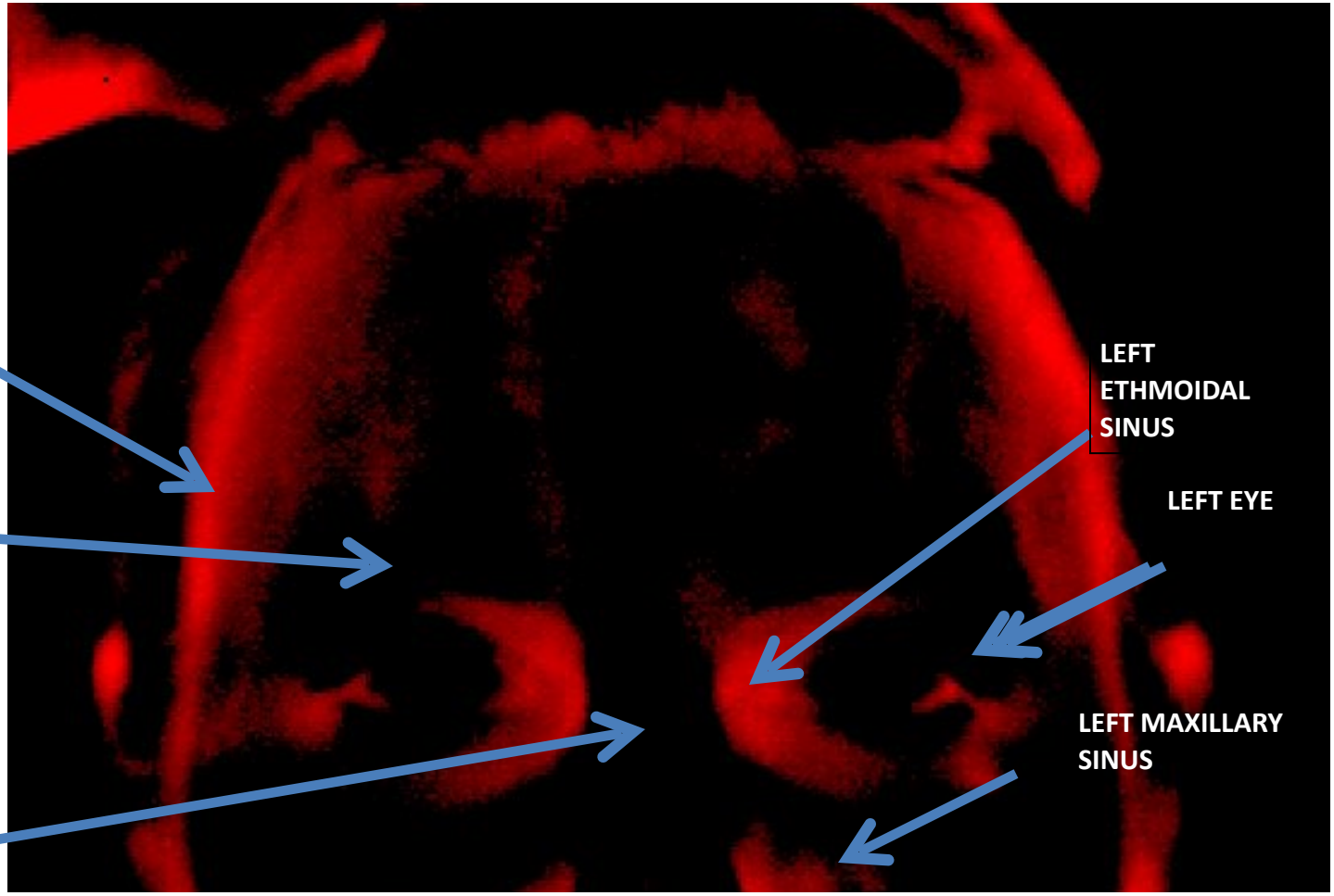
EXAMPLES OF INFRARED IMAGES

“NORMAL” INFRARED IMAGE

(37yo female)

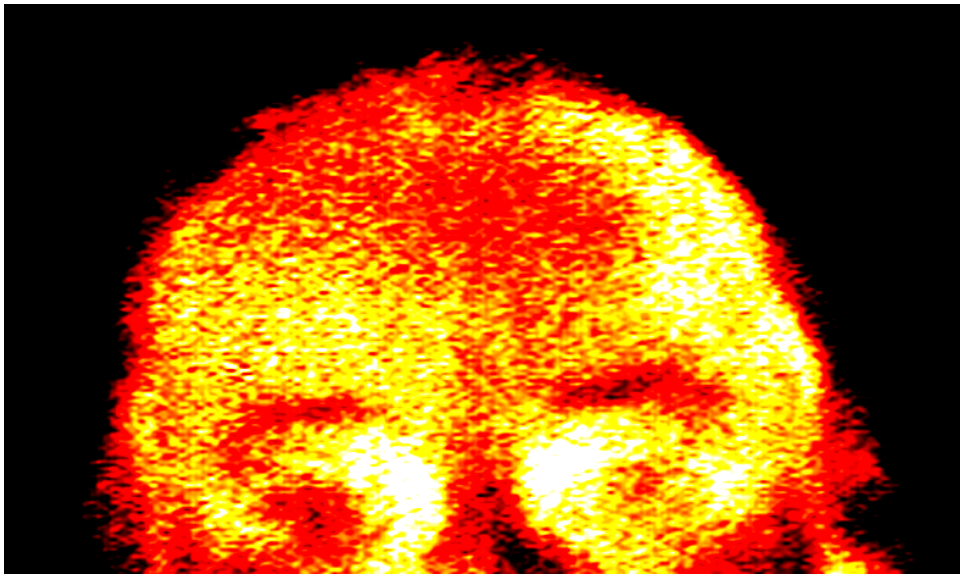


REFERENCE POINTS



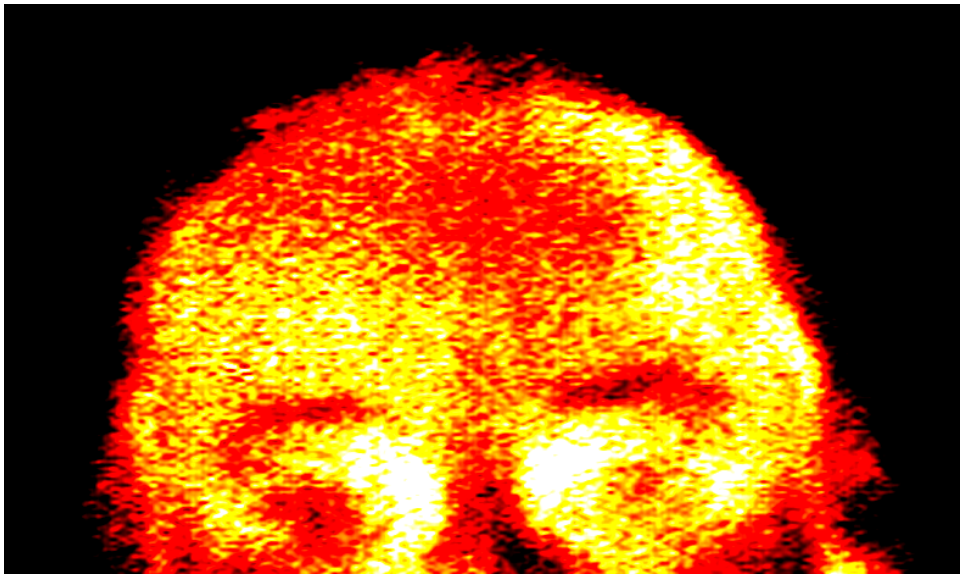
IMAGES OF MIGRAINE

41 yo female, left temporal migraine with bilateral ethmoidal sinusitis. (Old, original infrared camera).



IMAGES OF MIGRAINE

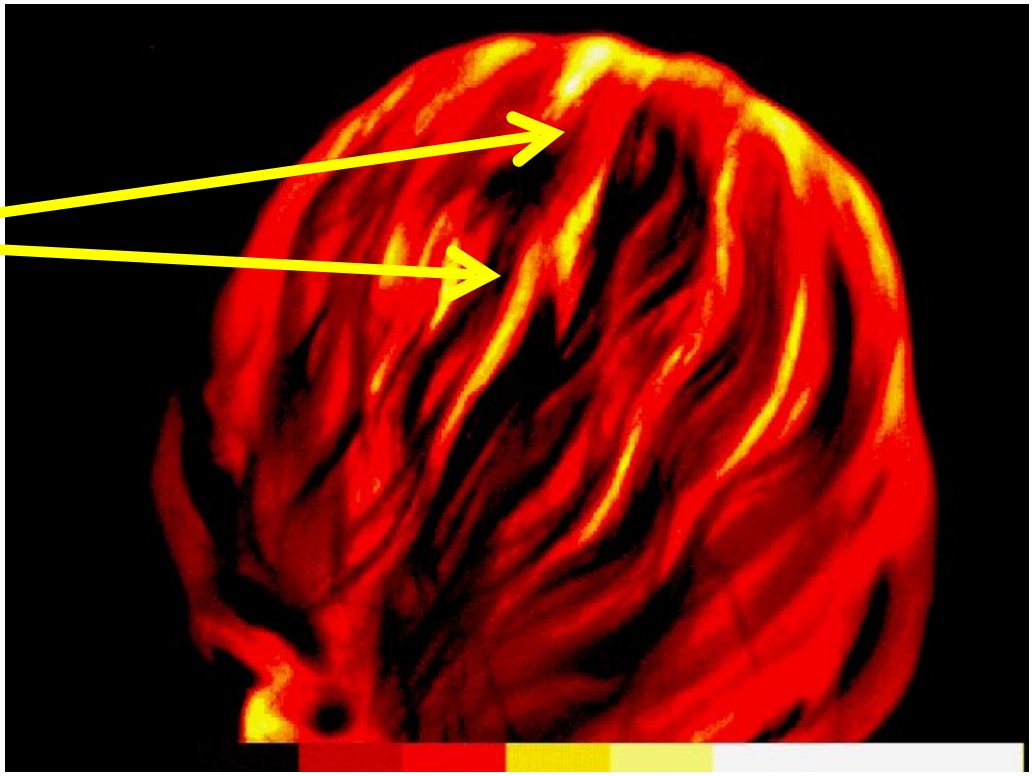
41 yo female, left temporal migraine with bilateral ethmoidal sinusitis. (Old, original infrared camera).



Sinusitis often accompanies migraine and may be causative by irritating the trigeminal nerve or it can be a false symptom created by the migraine.

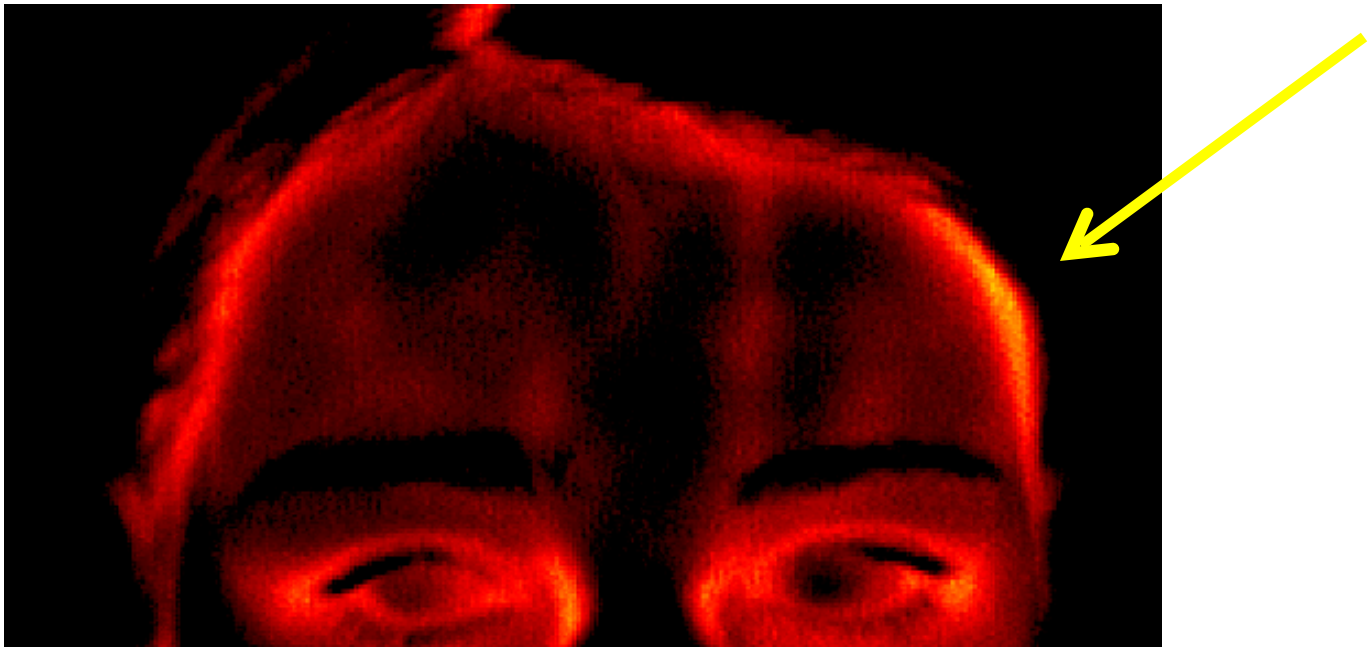
IMAGES OF MIGRAINE

11 yo female, migraine, occipital pain.



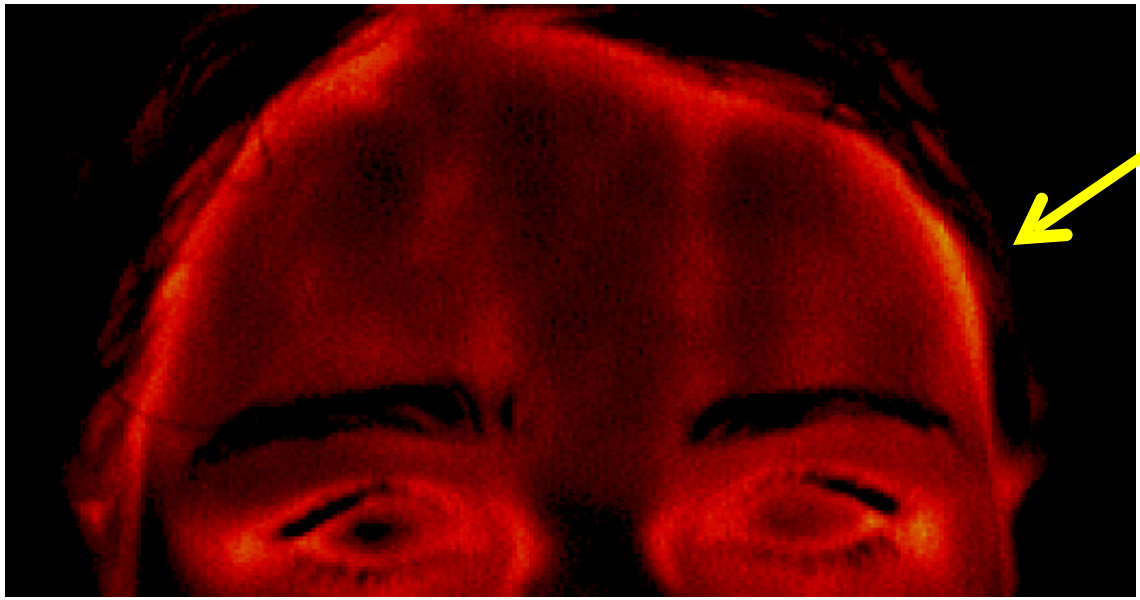
IMAGES OF MIGRAINE

13 yo female, migraine, left temporal.



IMAGES OF MIGRAINE

13 yo female, migraine, end of session, no pain. Temporal arteries less hot, forhead normalized.

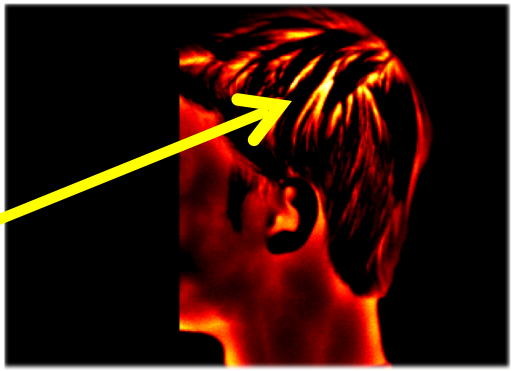


Note: people with migraines often image with one or both temporal arteries as hot, even when a migraine is not in progress, and even if they are not the site of the head pain.

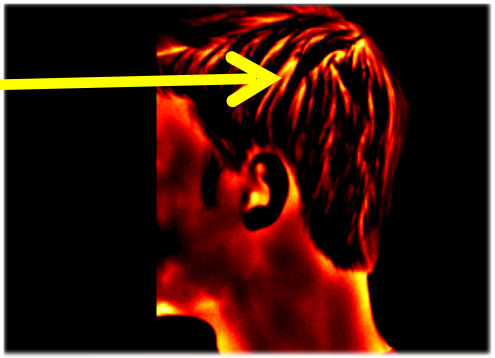
IMAGES OF MIGRAINE

16 yo male, left posterior non-focal head pain, baseline and post treatment.

LEFT POSTERIOR HEADACHE, 7/26/02, 7:15AM



POST TREATMENT, 7:48AM, HEADACHE ALMOST GONE

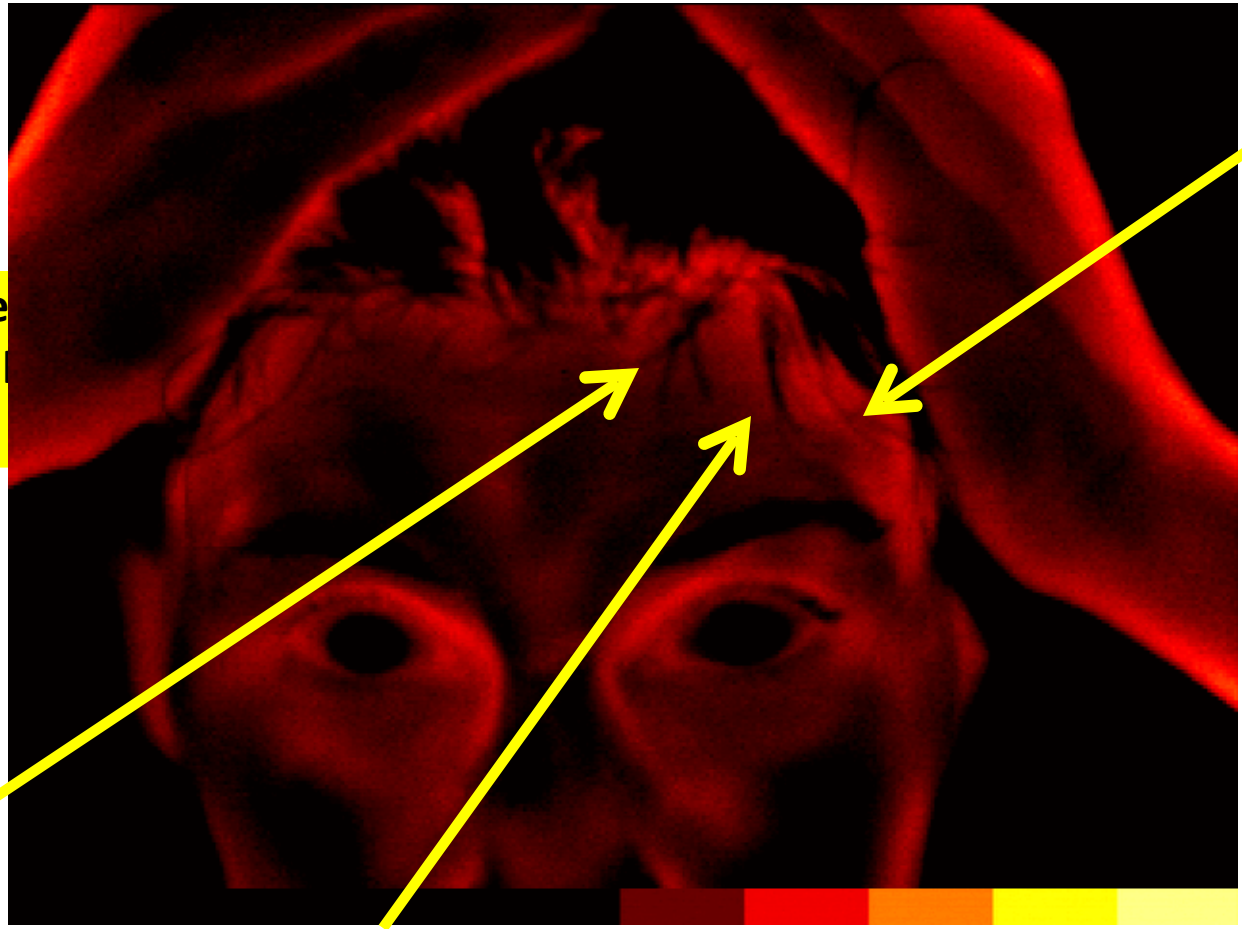


LOWEST INFRARED OUTPUT<----------->HIGHEST INFRARED OUTPUT

IMAGES OF MIGRAINE

38 yo female, lifetime of migraines and "other" types of headaches.

IMAGES OF MIGRAINE



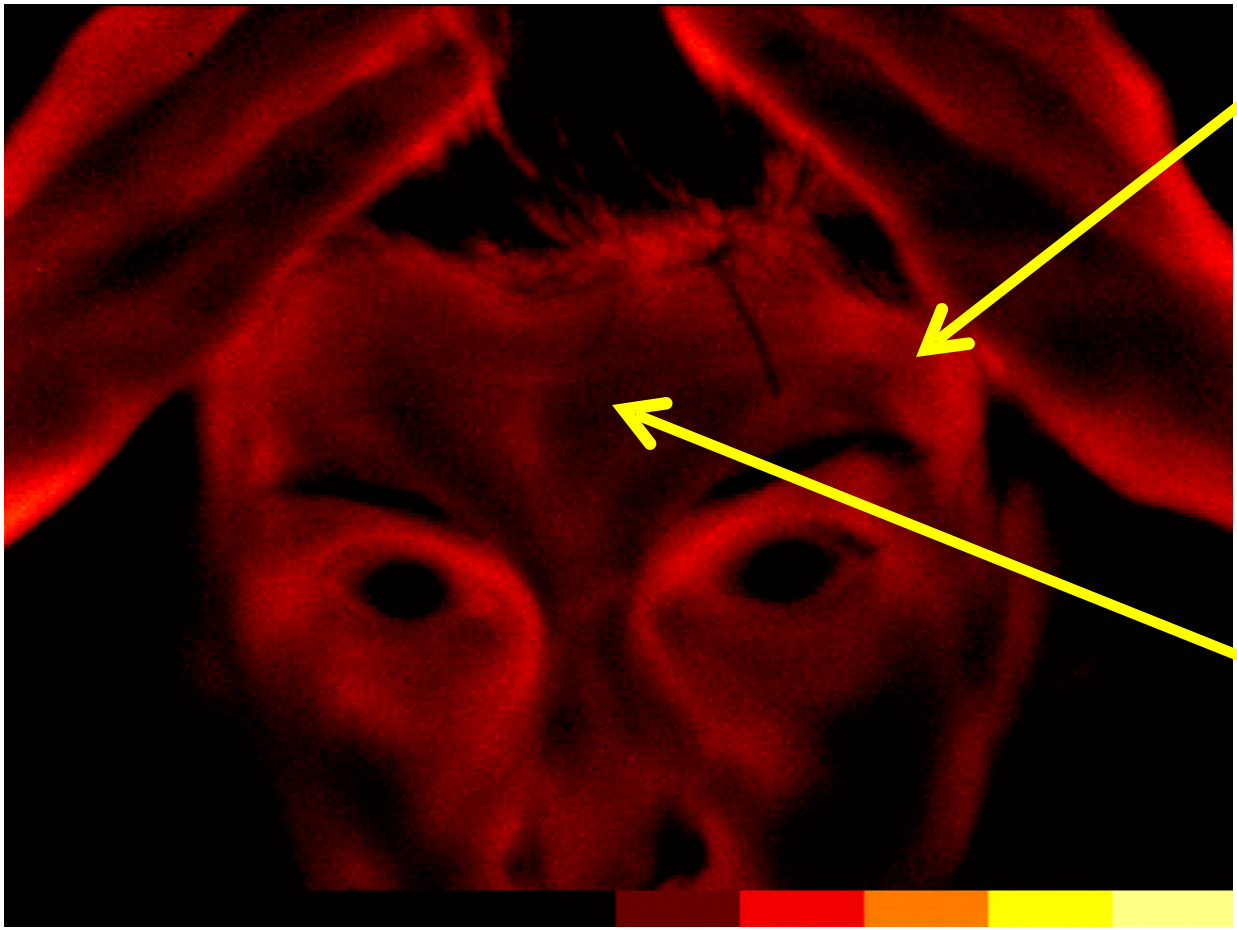
61 yo female left temporal migraine.

Head pain.

Strands of hair. Hair is opaque to infrared.

IMAGES OF MIGRAINE

61 yo female, left temporal migraine, end of session, migraine gone.



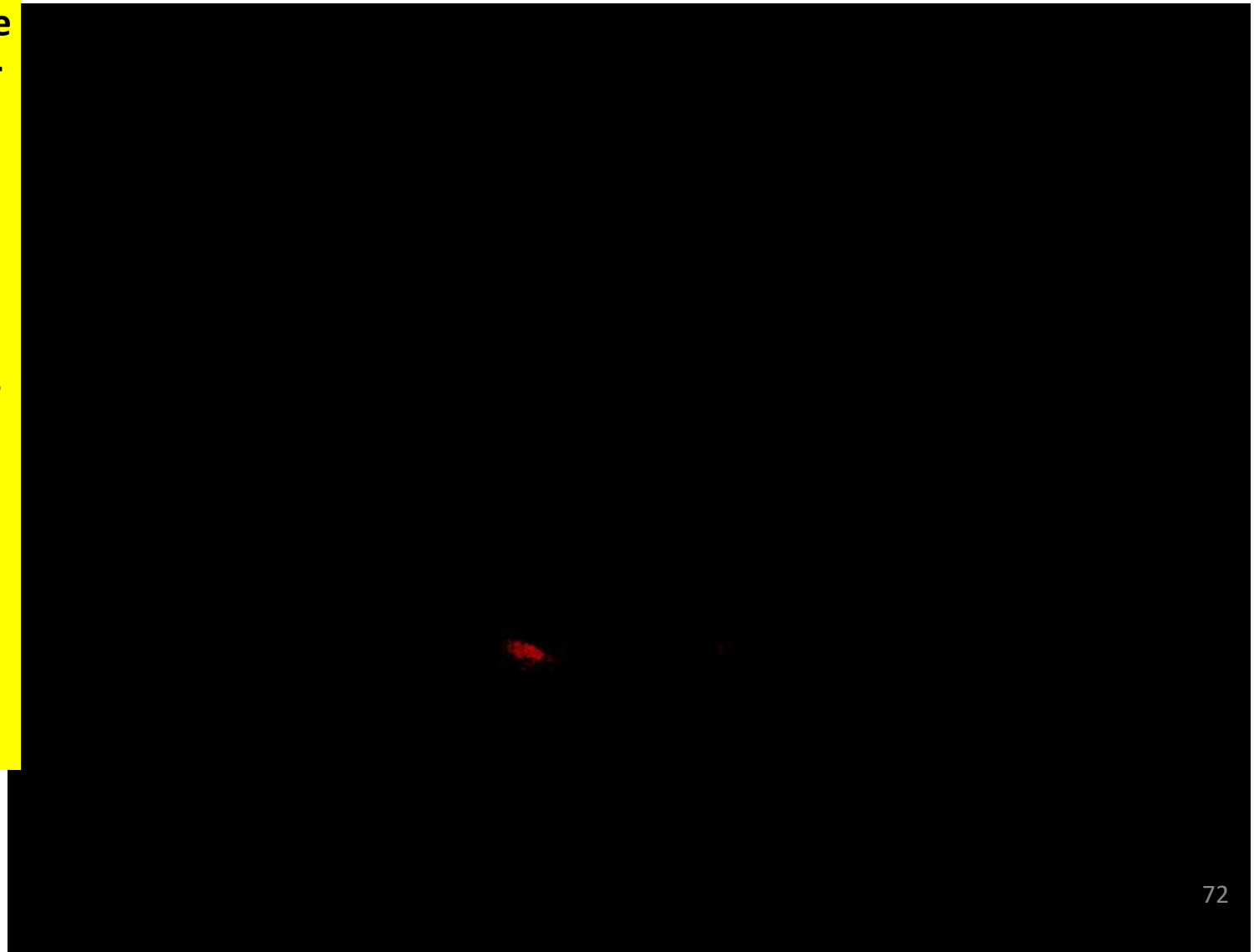
Less thermal output.

Increased PFC output and more uniform.

IMAGES OF DEPRESSION

DEPRESSION

22yo right handed male, periodic suicidal depression. The referral was for ADHD. He did not tell me about the depression at first. He had lived with it his whole life and was just used to it. This was the baseline image before his first pIR HEG session.



DEPRESSION

End of first session. Feeling much better in terms of mental focus and depression.

Baseline, second session, one week later.

DEPRESSION

End of second session, one week later.

DEPRESSION

DEPRESSION

Baseline, third session, two weeks later. Progressive lifting of depression.

End of third session. Progressive lifting of depression.

DEPRESSION

End of third session. Progressive lifting of depression.

DEPRESSION
points of interest

Both his depression and attentional problems needed continuous maintenance. He ended up with his own pIR HEG system that he uses regularly.

DEPRESSION
points of interest

Monitoring infrared images before and after each session can produce potentially informative patterns that are meaningful to that individual, regardless of the presenting symtoms.

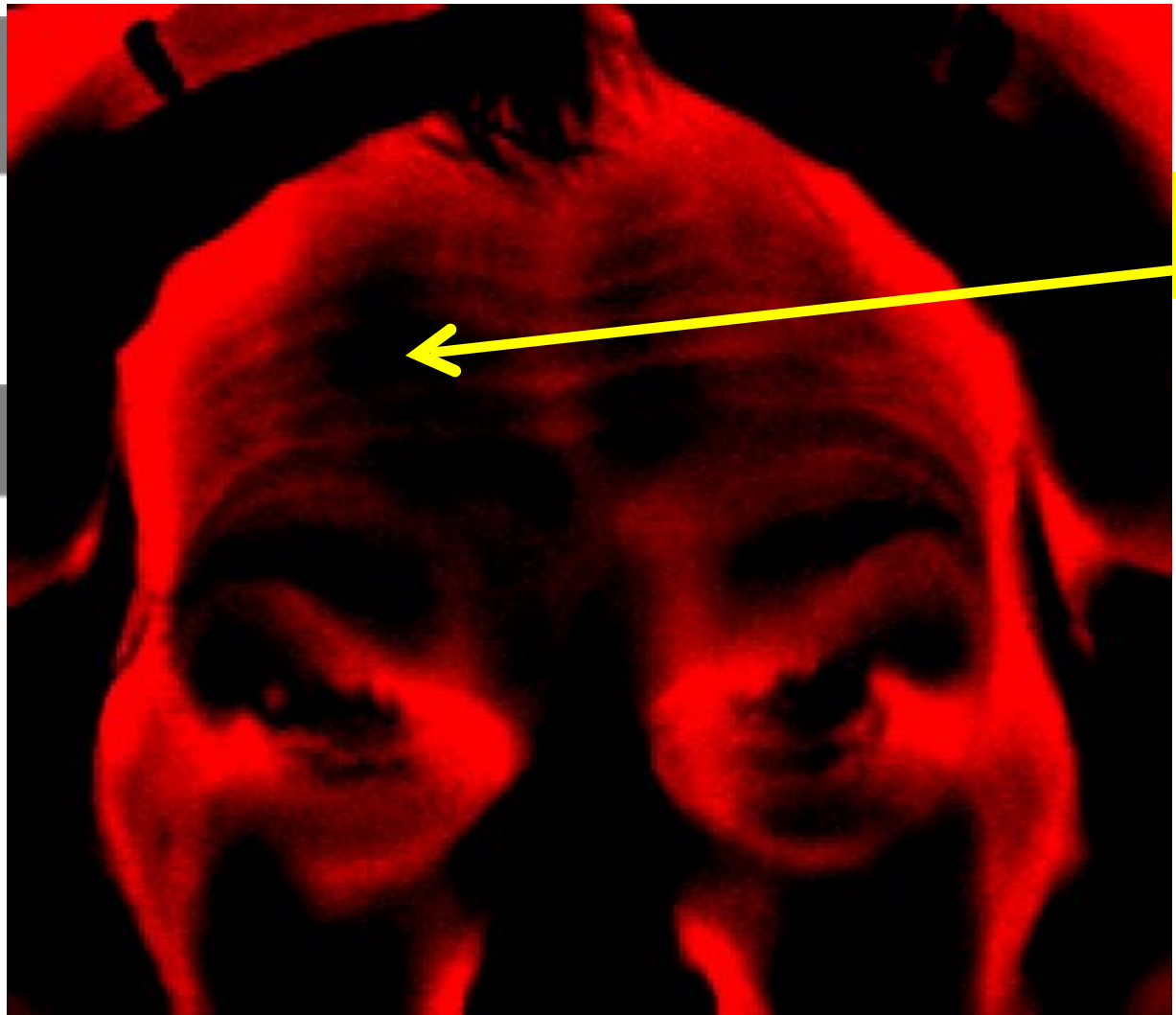
DEPRESSION
Patterns over time.

53yo female, depression, reverse lateralized for language. VERY IMPORTANT CONCEPT.

67yo female, MS, depression, reverse lateralized for language

Right side of her brain is dominant for language.

She "talks" with her left hand.



Depression marker.

IMAGE VARIABLES

- **A dark area over the left eye can correlate with depression, delusions, or language problems for individuals who are left brain lateralized for language.**

- **If language lateralization is reversed, the meaning of the images is also reversed. For example, depression will be seen on the right side instead.**

ANXIETY – CLINICAL IMPRESSIONS

- **Anxiety does not localize very specifically on infrared imaging, but the images are usually abnormal and typically show a low level of PFC activity. Also, it tends to be present with other emotions, which complicates the interpretation of the image.**

ANXIETY

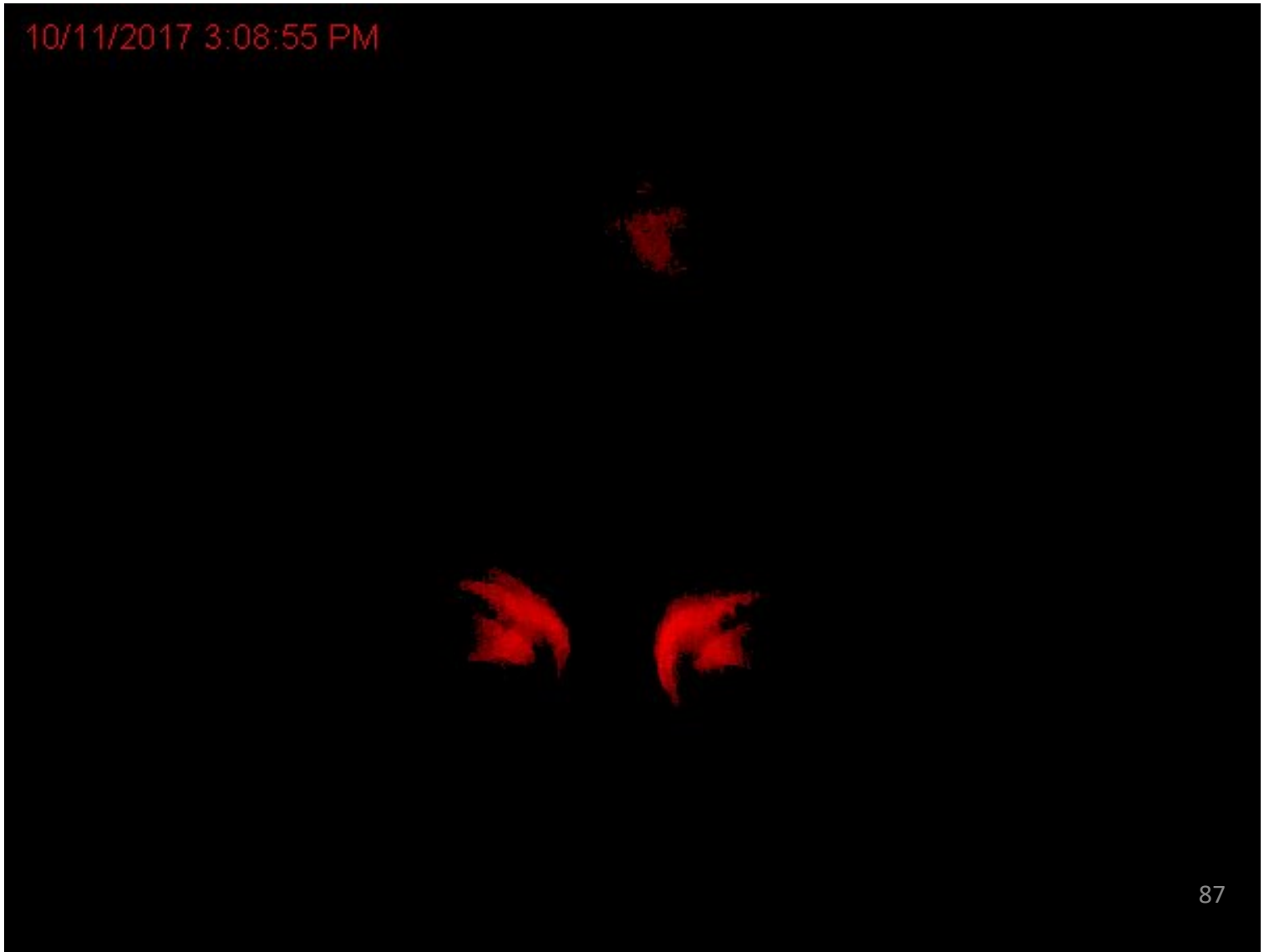
17yo female, severe anxiety, occasionally rising to panic. Images from 6 sessions. Baseline image, first session.

17yo female, severe anxiety, occasionally rising to panic. End of first session.

ANXIETY

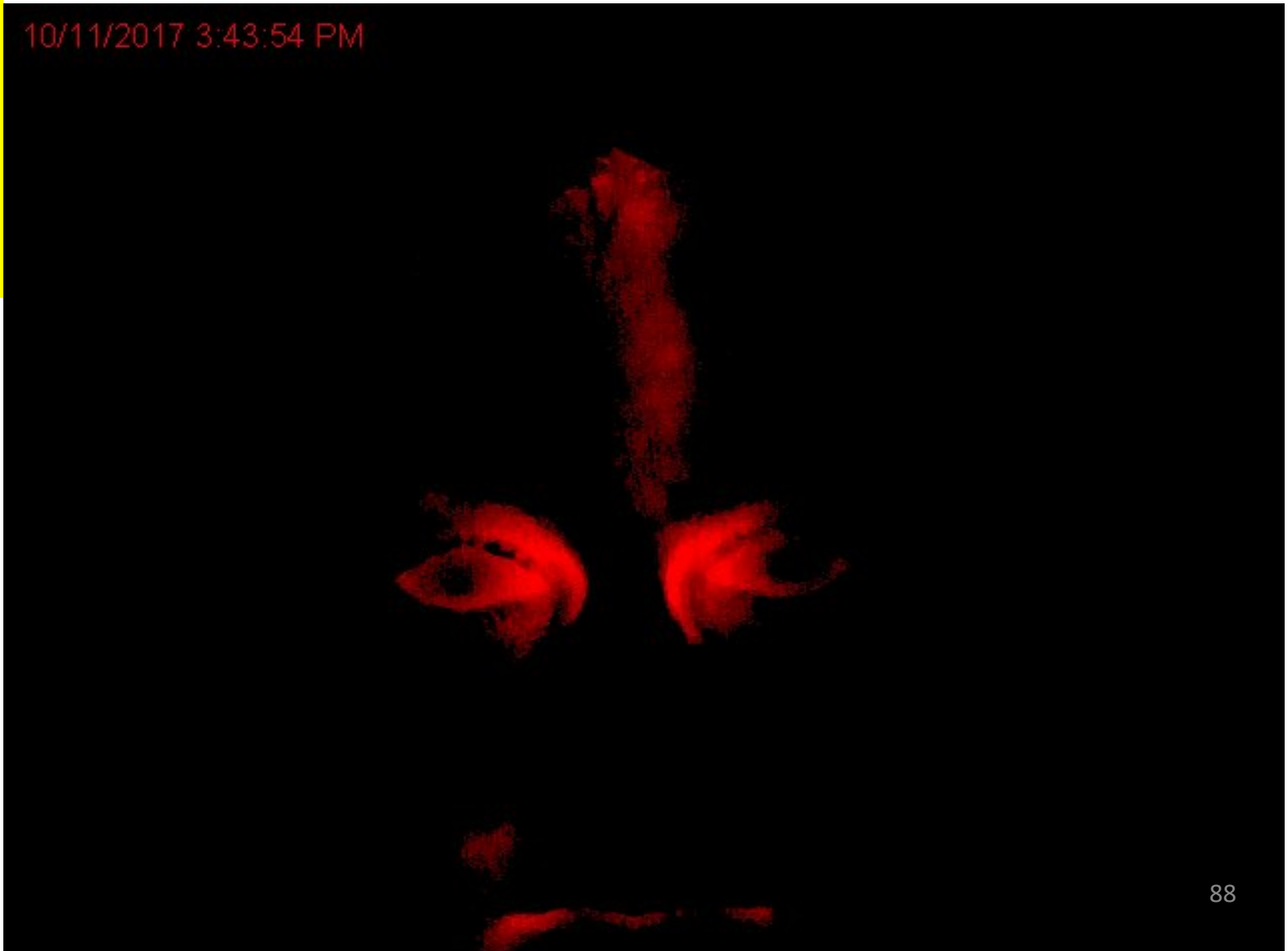
ANXIETY

17yo female, severe anxiety, occasionally rising to panic. Baseline of second session one week later.



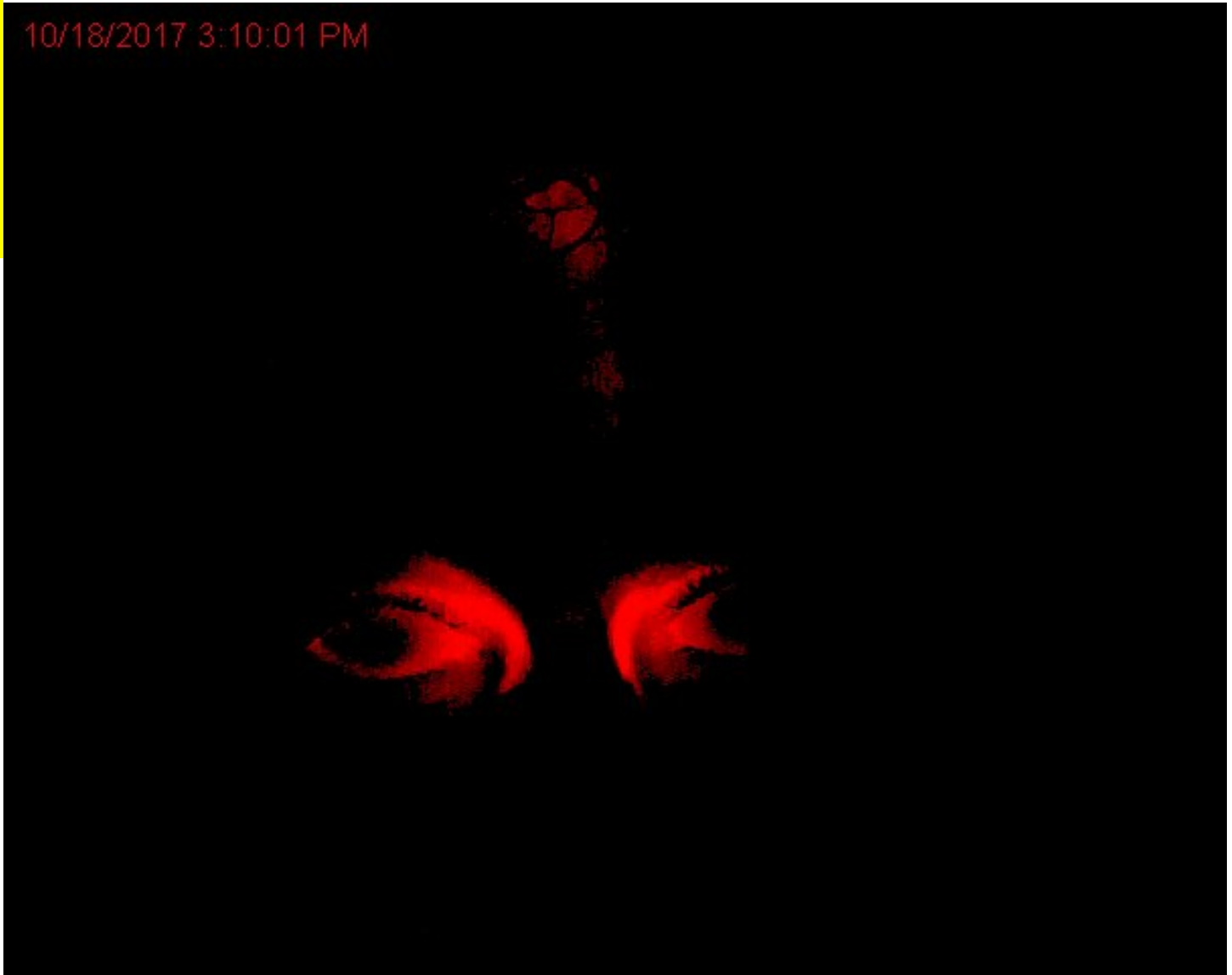
ANXIETY

17yo female, severe anxiety, occasionally rising to panic. End of second session one week later.



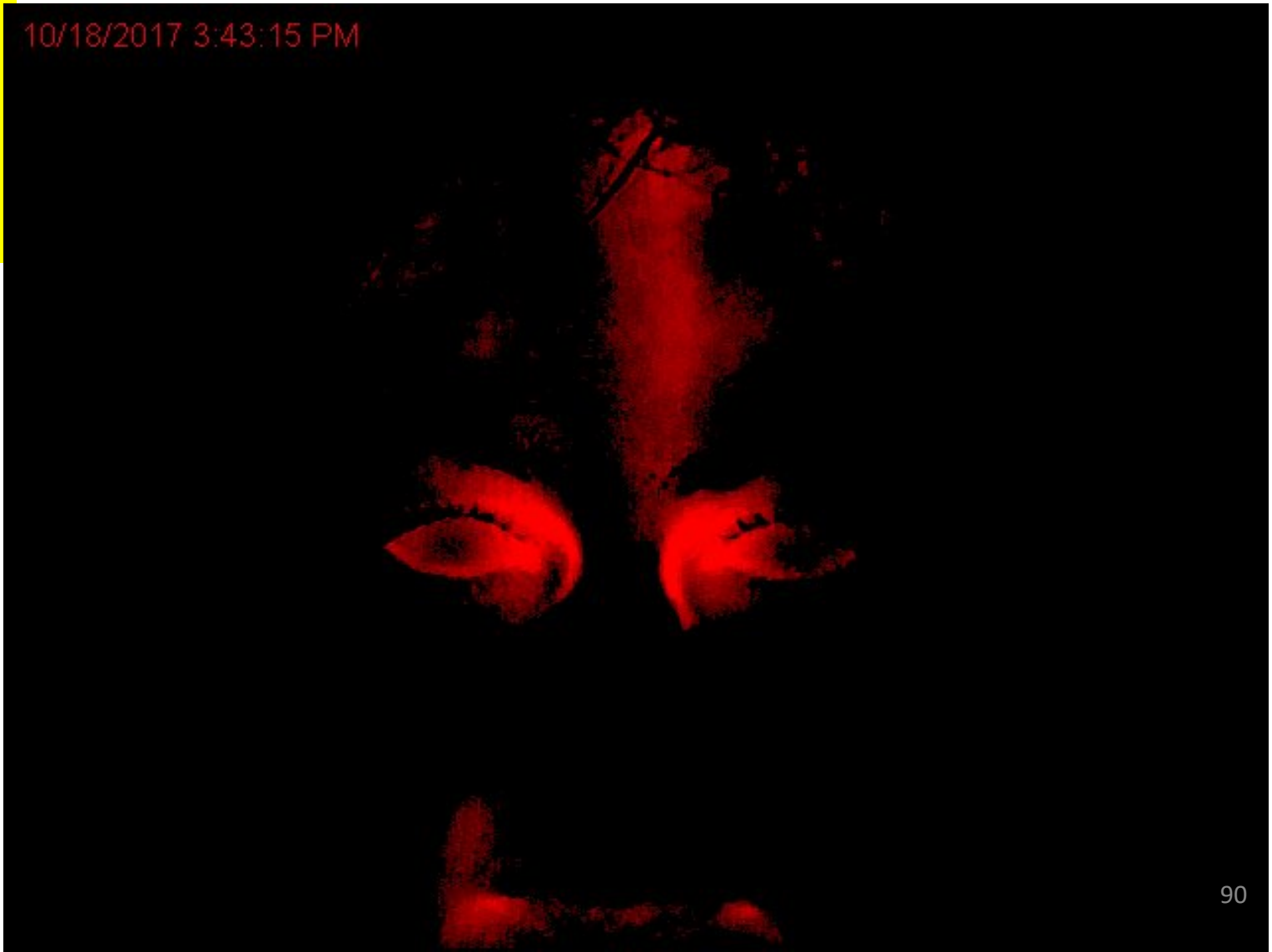
17yo female, severe anxiety, occasionally rising to panic. baseline of third session.

ANXIETY



ANXIETY

17yo female, severe anxiety, occasionally rising to panic. End of third session..



ANXIETY

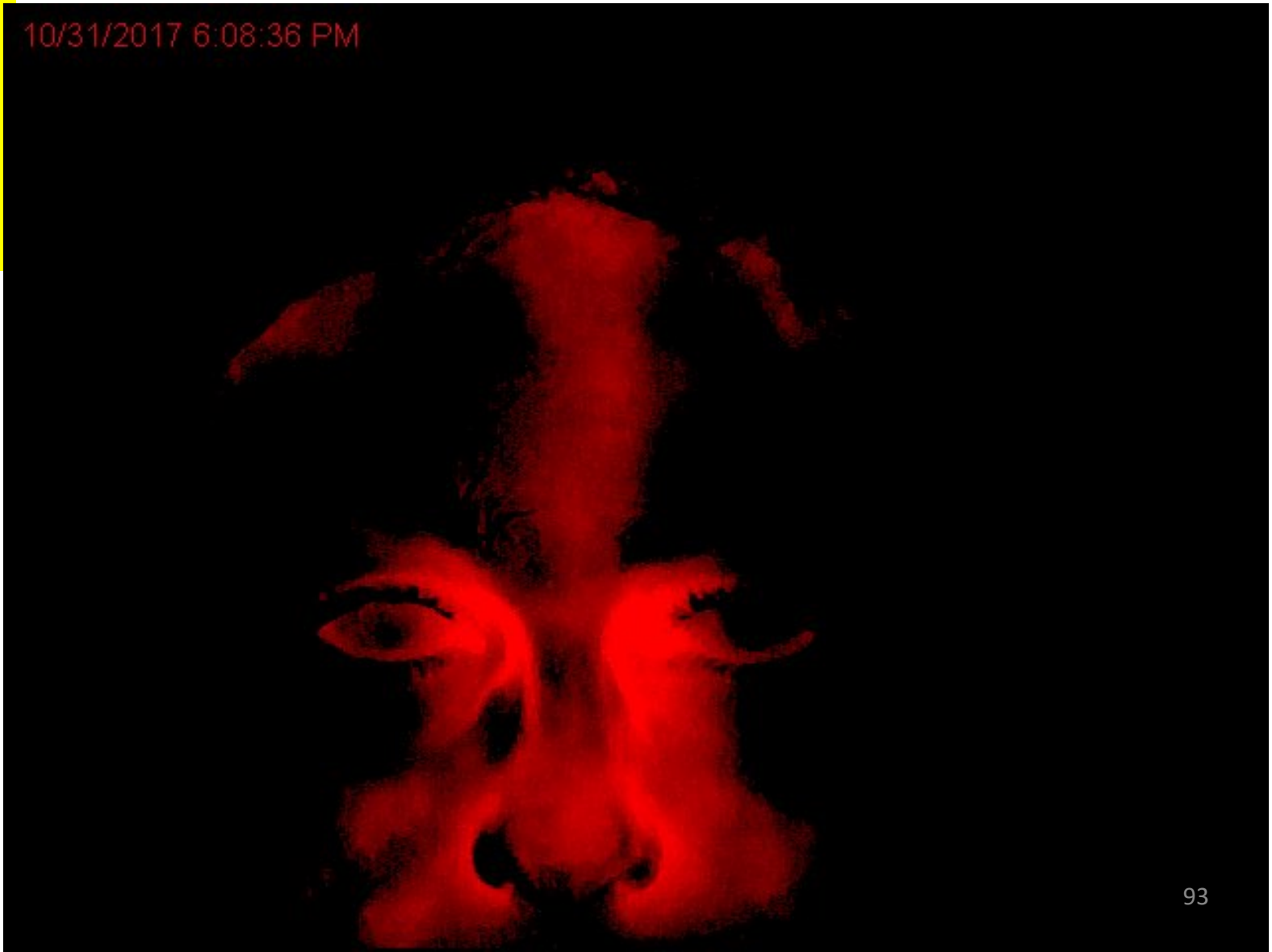
17yo female, severe anxiety, occasionally rising to panic. Baseline of fourth session.

ANXIETY

17yo female, severe anxiety, occasionally rising to panic. End of fourth session.

ANXIETY

17yo female, severe anxiety, occasionally rising to panic. Baseline for fifth session.



ANXIETY

17yo female, severe anxiety, occasionally rising to panic. End of fifth session.

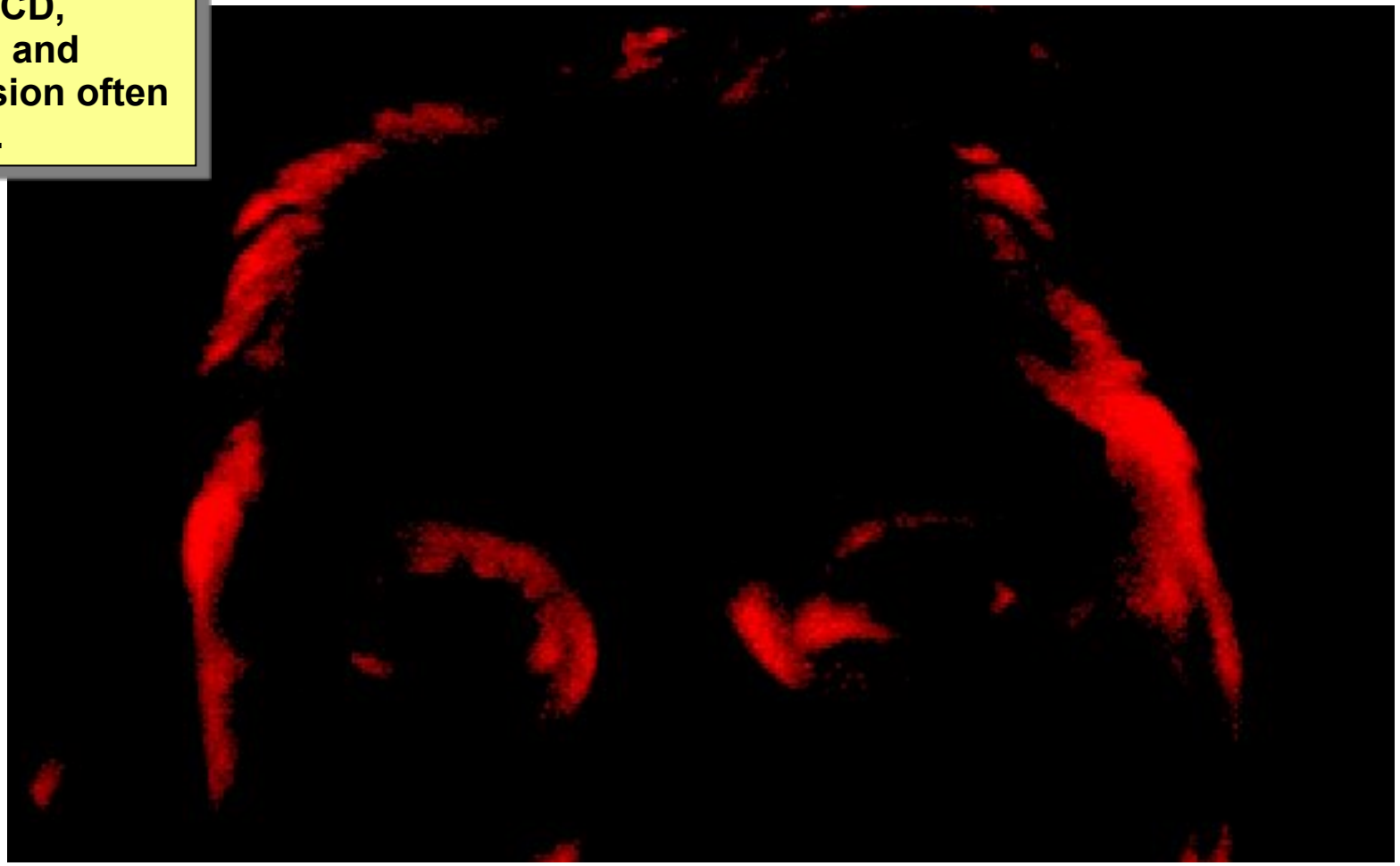
17yo female, severe anxiety, occasionally rising to panic..

ANXIETY

- She has stabilized nicely. Self reports are that both background anxiety and surges of anxiety are “softer and gentler”. At this point we spread the appointments farther apart.
- Note: the effect is from thought to be from frontal inhibition rather than from relaxation. Inhibition is smoother and lasts longer.

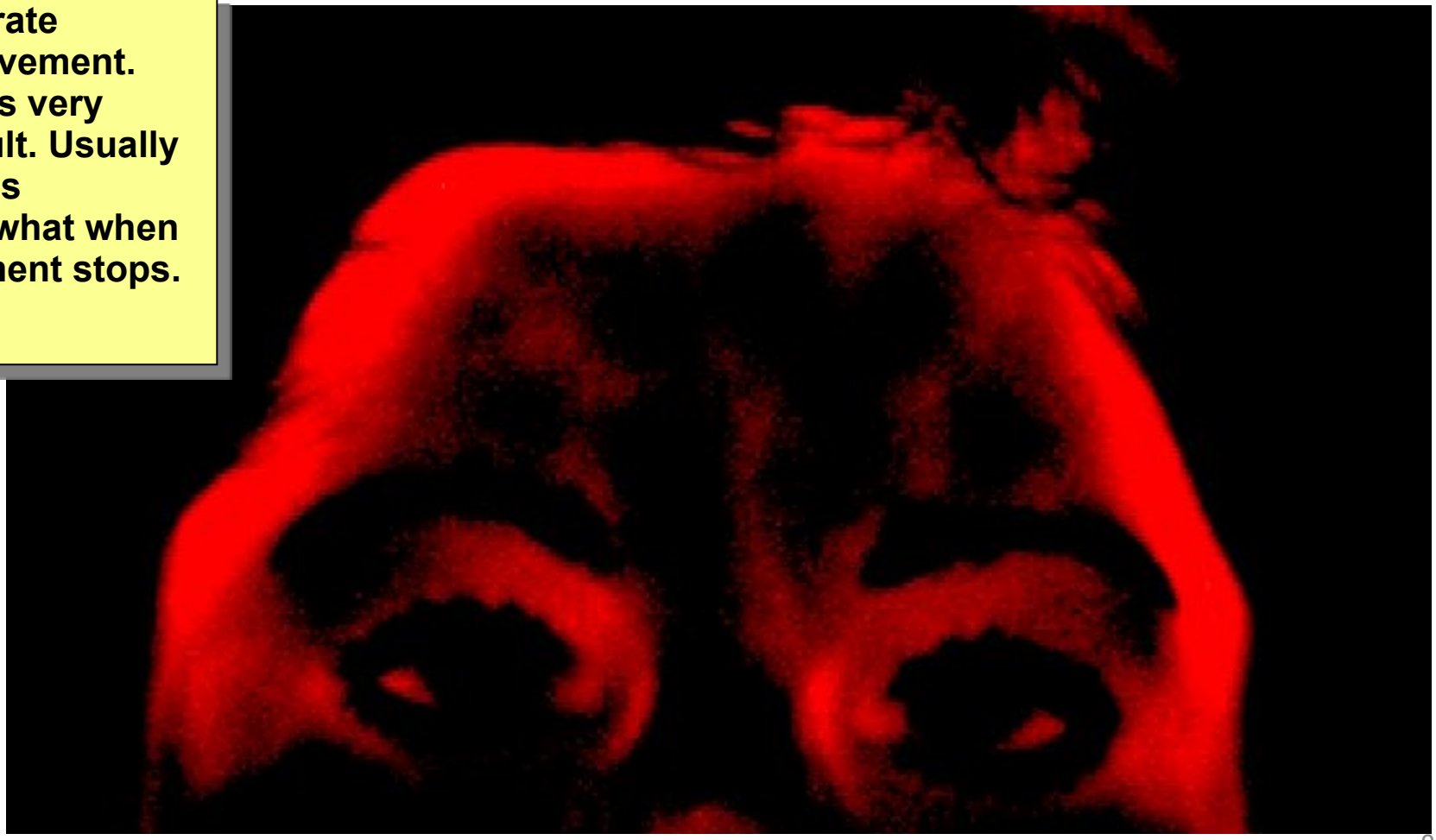
Severe OCD, 20yo female (anxiety related disorder).

Note: OCD, anxiety, and depression often coexist.



Same girl after 6 months

Moderate improvement. OCD is very difficult. Usually returns somewhat when treatment stops.



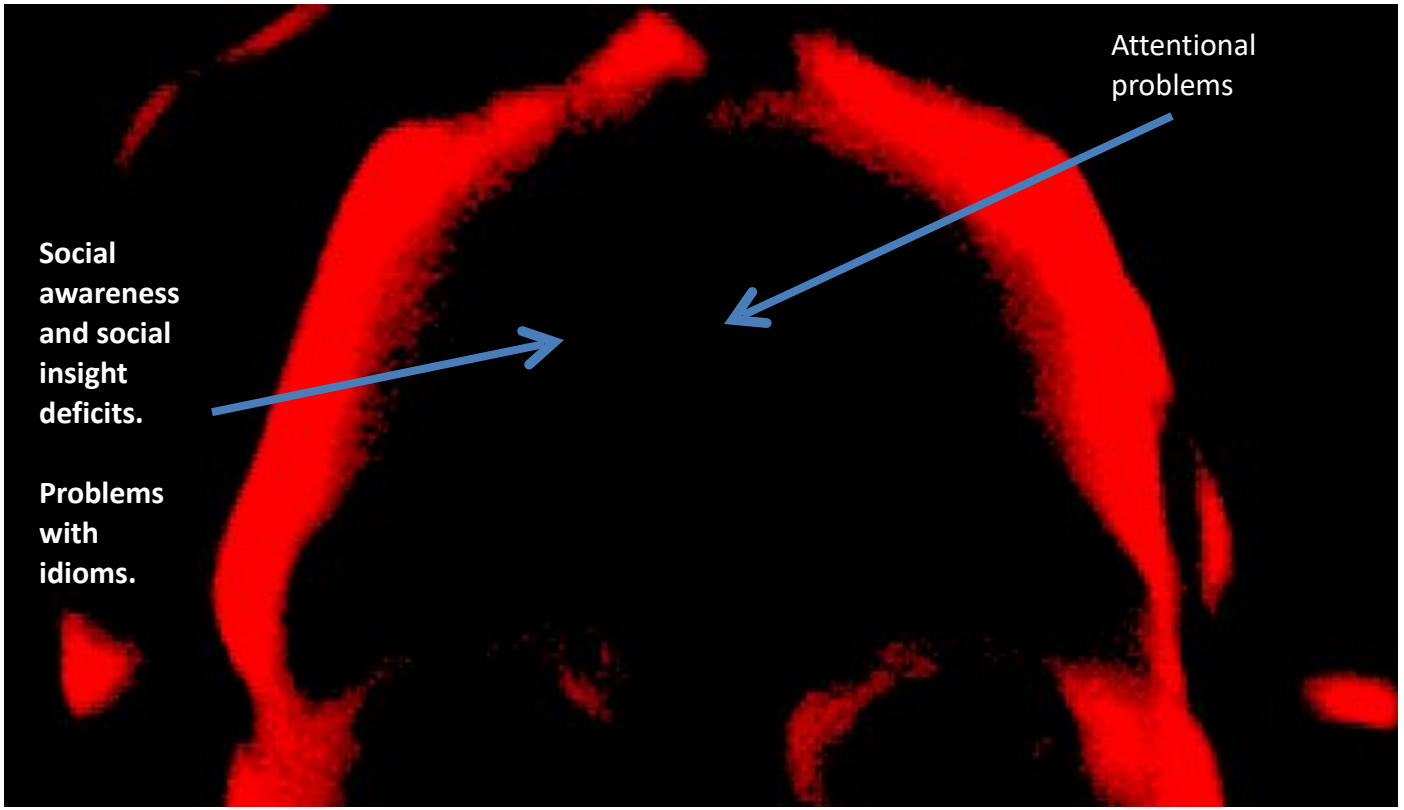
AUTISM/ASPERGER SPECTRUM

Images generally localize to the non-language side of the forehead (usually over the right eye) and present as low level of activity (dark).

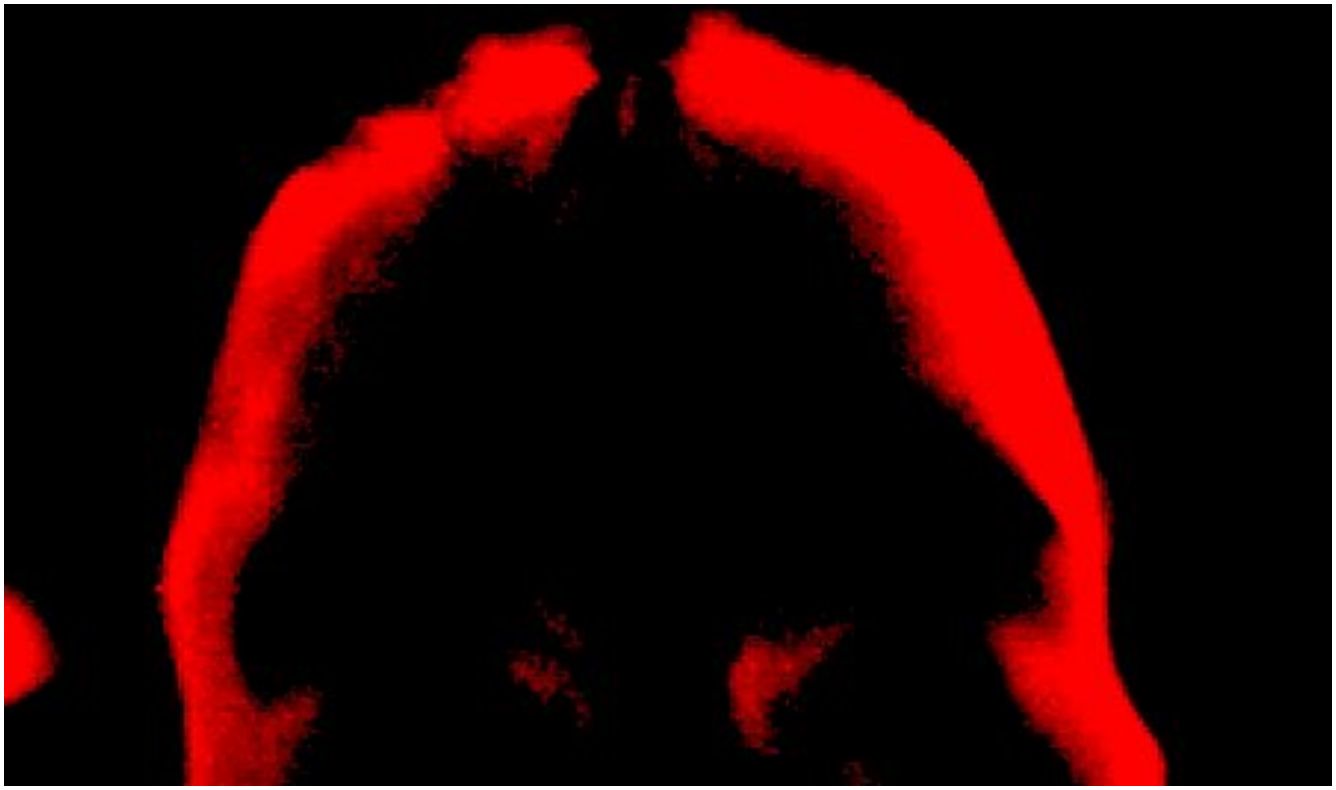
On an infrared image, Autism and Depression are on opposite sides, but if the person is reverse lateralized, the interpretation is also reversed.

AUTISM SPECTRUM WITH ADHD

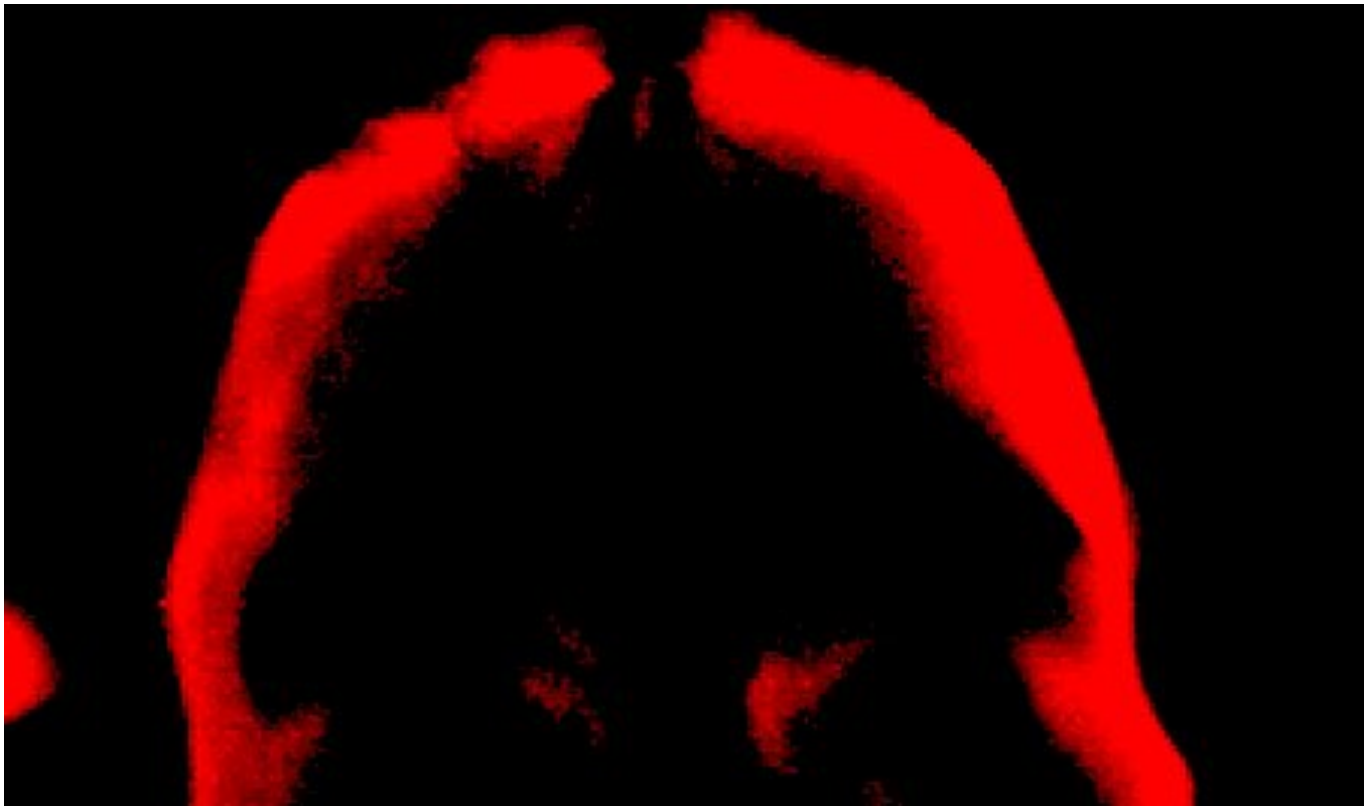
12yo male



AUTISM SPECTRUM WITH ADHD, end of session.



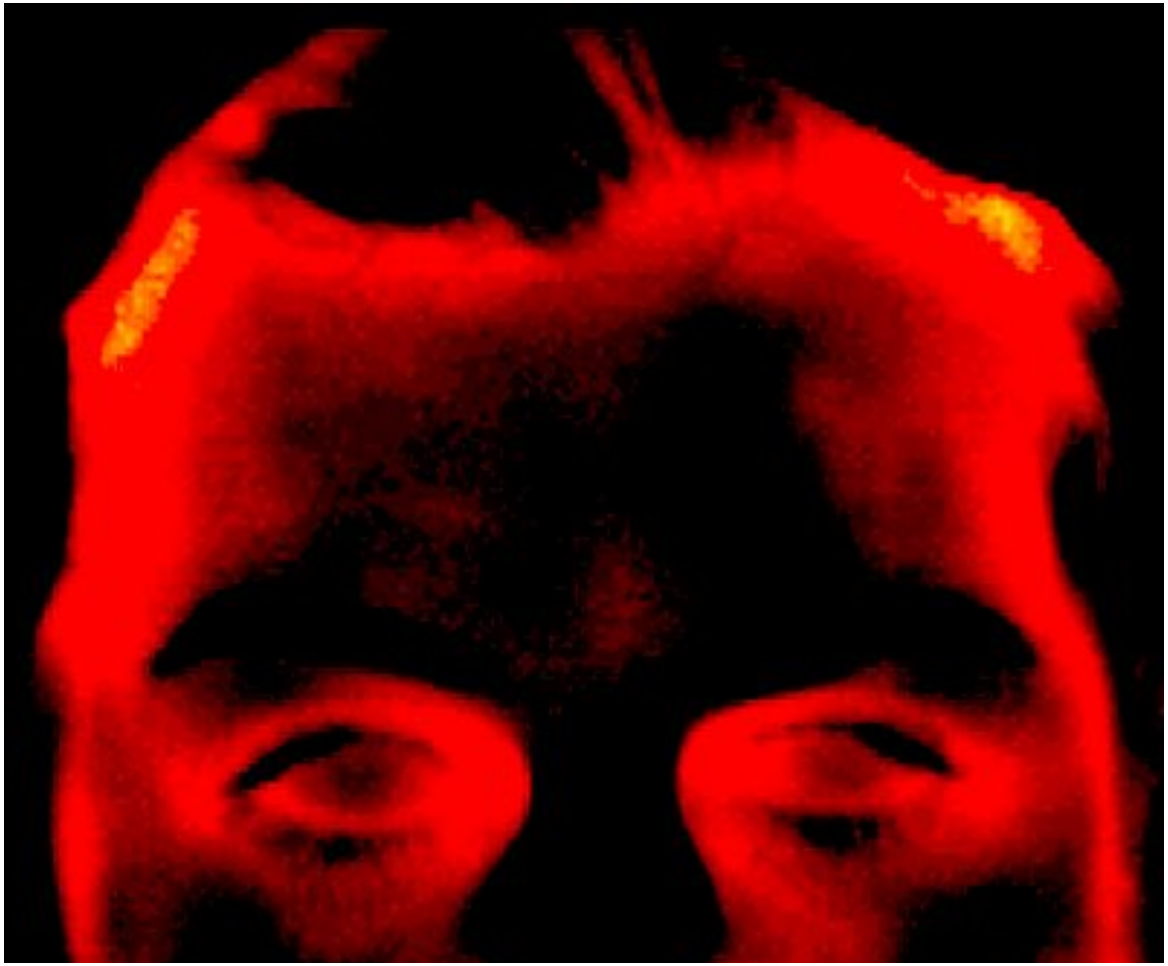
Clinical Comment: Behaviorally, autistic spectrum folk tend to respond to pIR HEG in a binary fashion! All of sudden, social insight kicks in, but after lots of sessions (60 to 80).



HEAD INJURY

(FRONTAL, 22yo male, cognitive deficits)

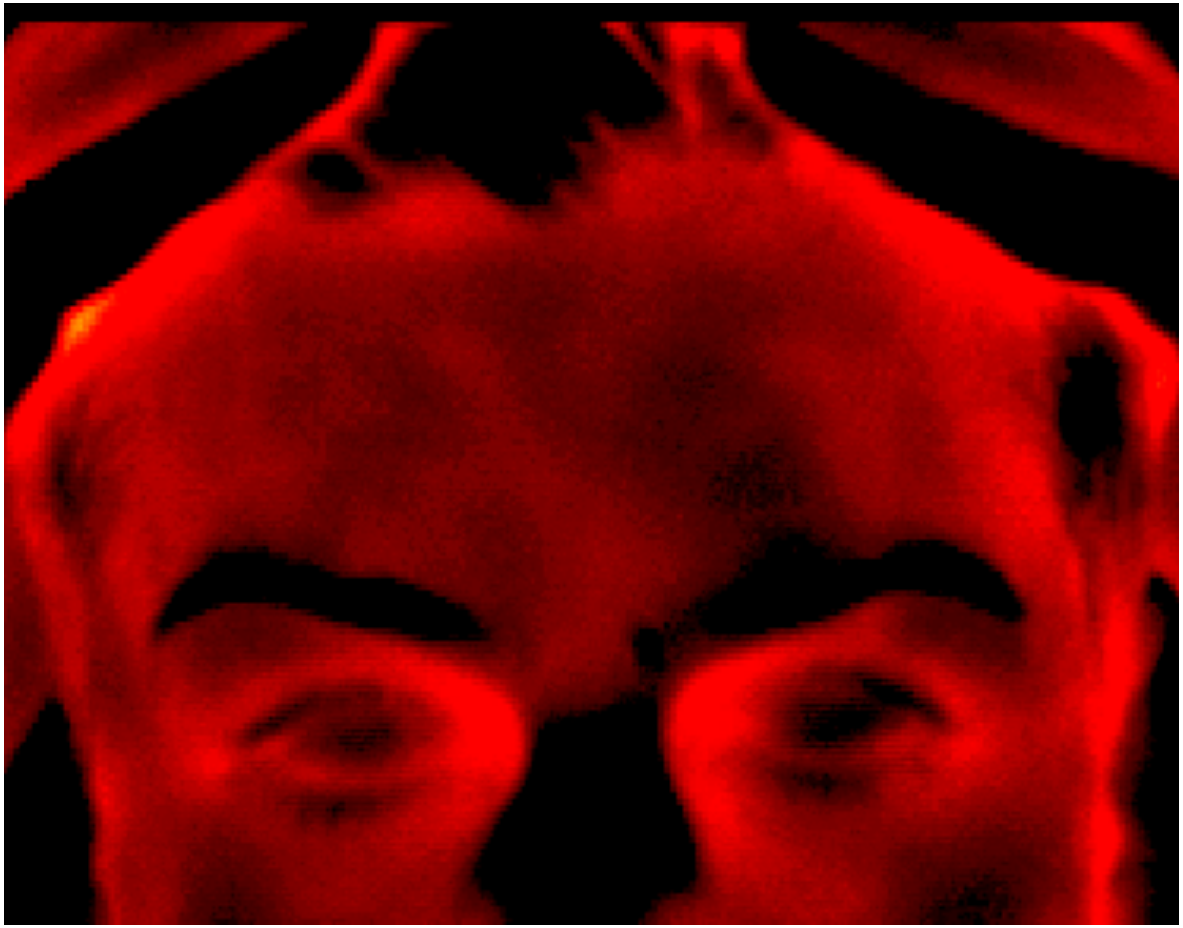
Hit tree head-on riding 4 wheeler with no helmet, 1 month coma. Language and thinking deficit.



Planned to go back to grad school, after 1 year of prefrontal cortical brain training. (Didn't end up going.)

(This was one of the preceding "normal" images.)

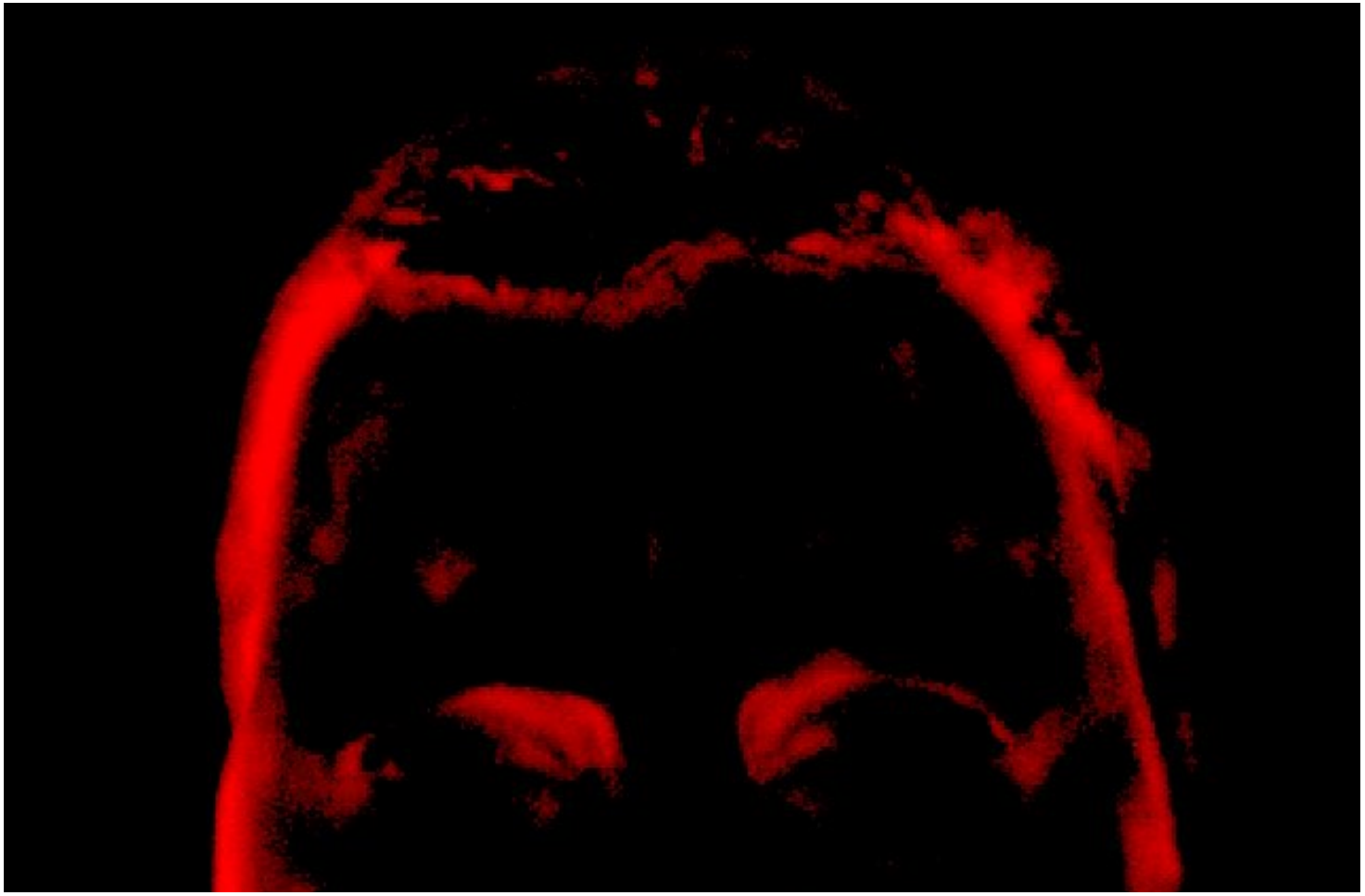
SAME FELLOW, 1yr later



270 volt, hand to other body part

HEAD INJURY

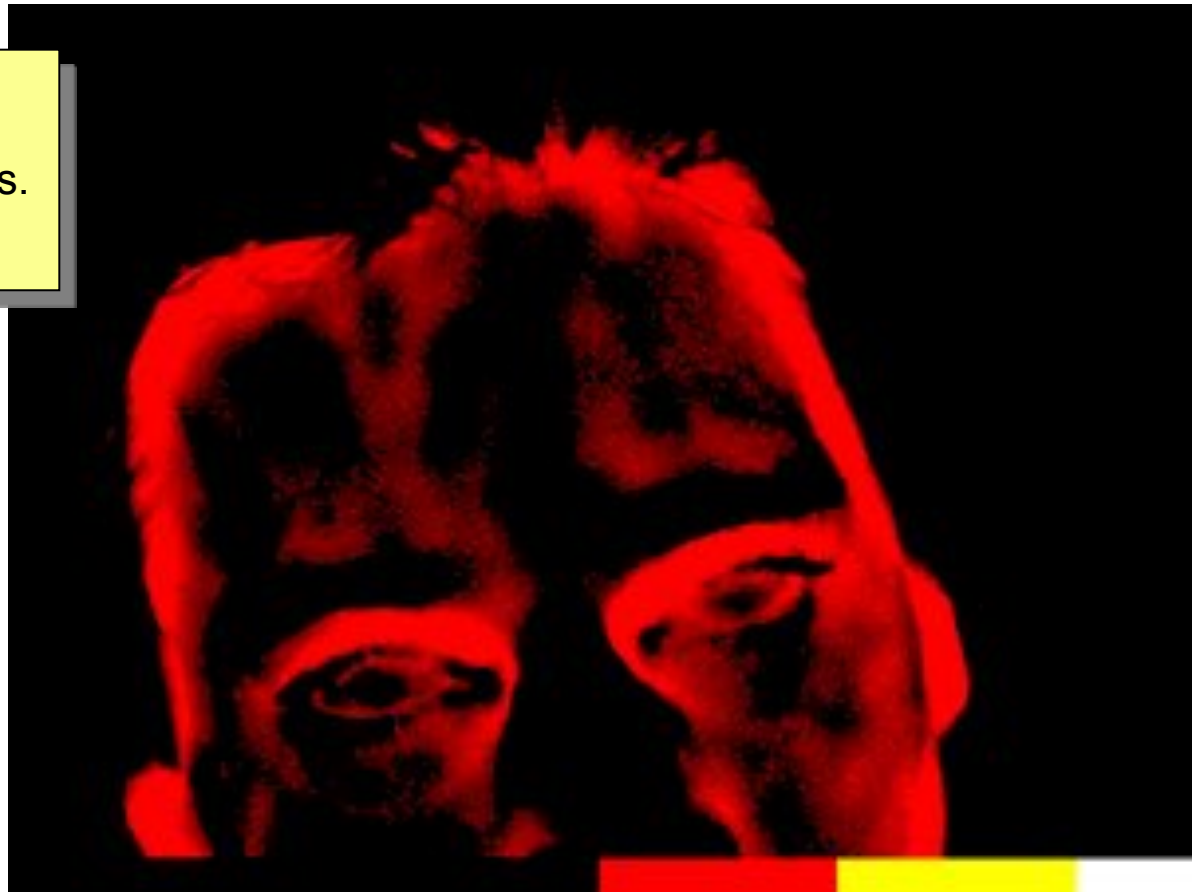
(ELECTROCUTED, 42yo male, dementia)



51yo male, car accident, hit by 18 wheeler, headaches, depression, mental focus problems.

Same fellow, end of 10 frontal neurofeedback session, headaches better, but still problems.

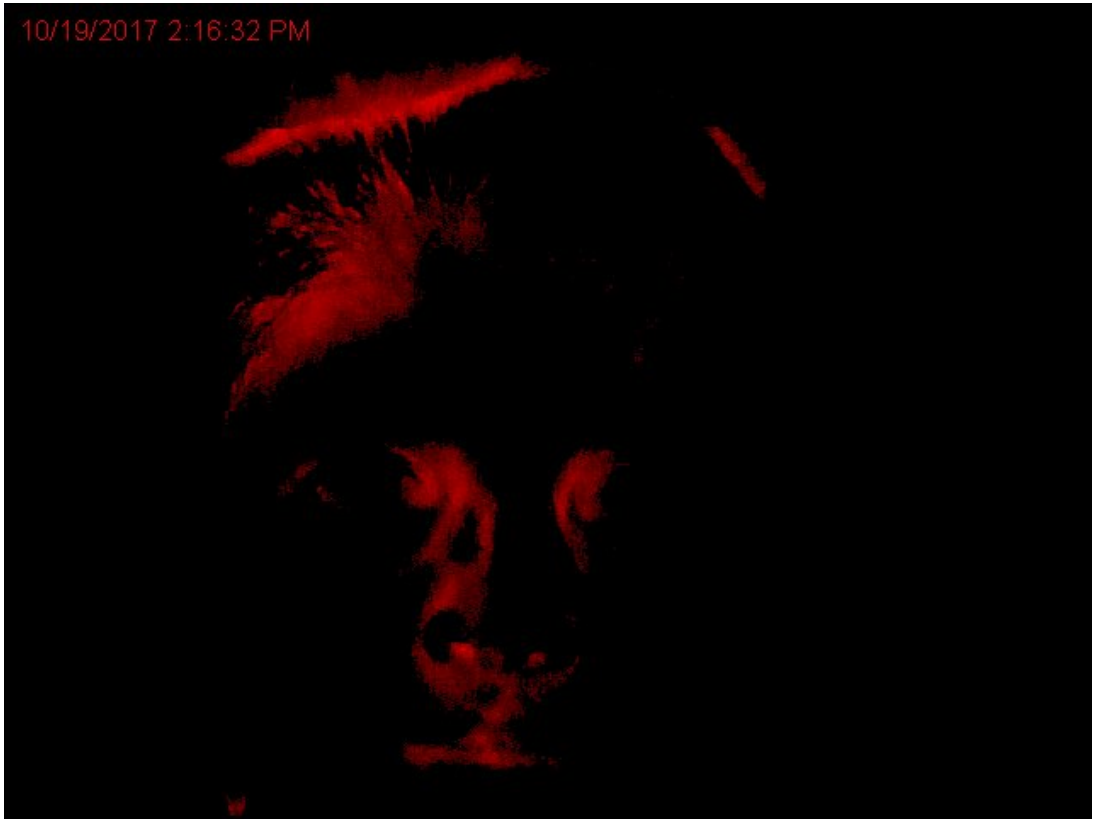
Some improvement in overall symptoms.



ANGER / RAGE

10yo male, rage episodes with limited or no memory for the event. (Left lateralized for language.)
Note: rage and autism look very similar in location and intensity on the IR image.

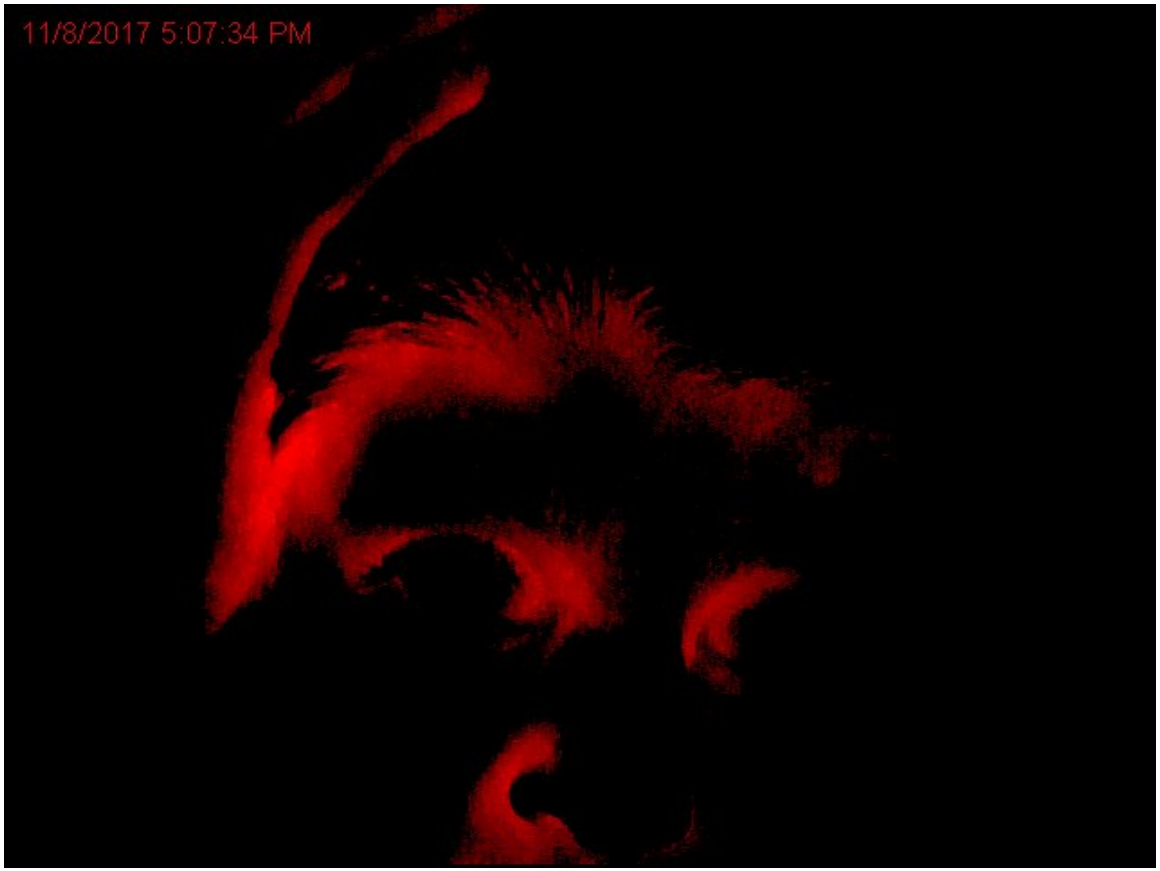
End of first session.



Baseline, second session.

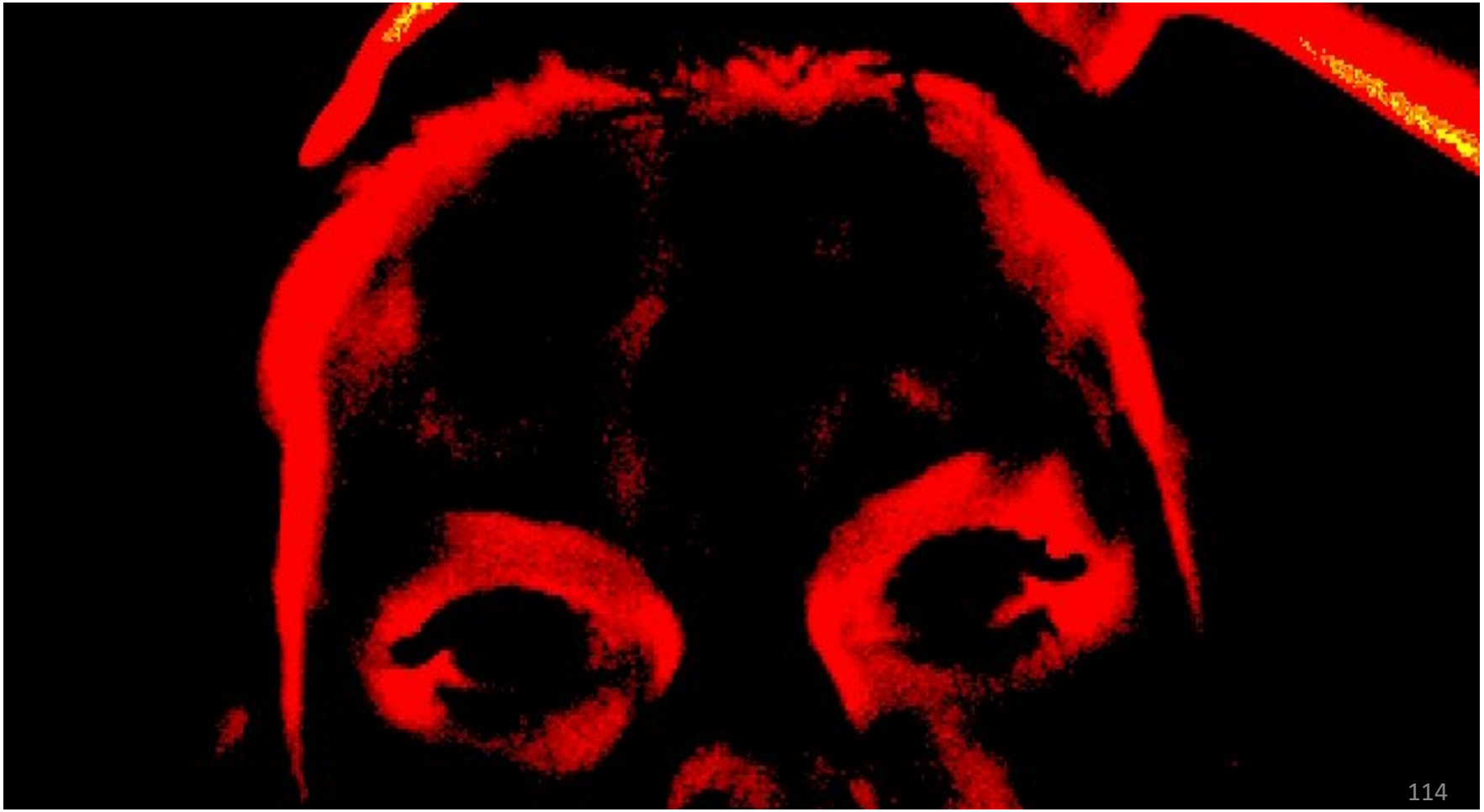
Baseline, third session.

Baseline, fourth session. (He had a good week!)

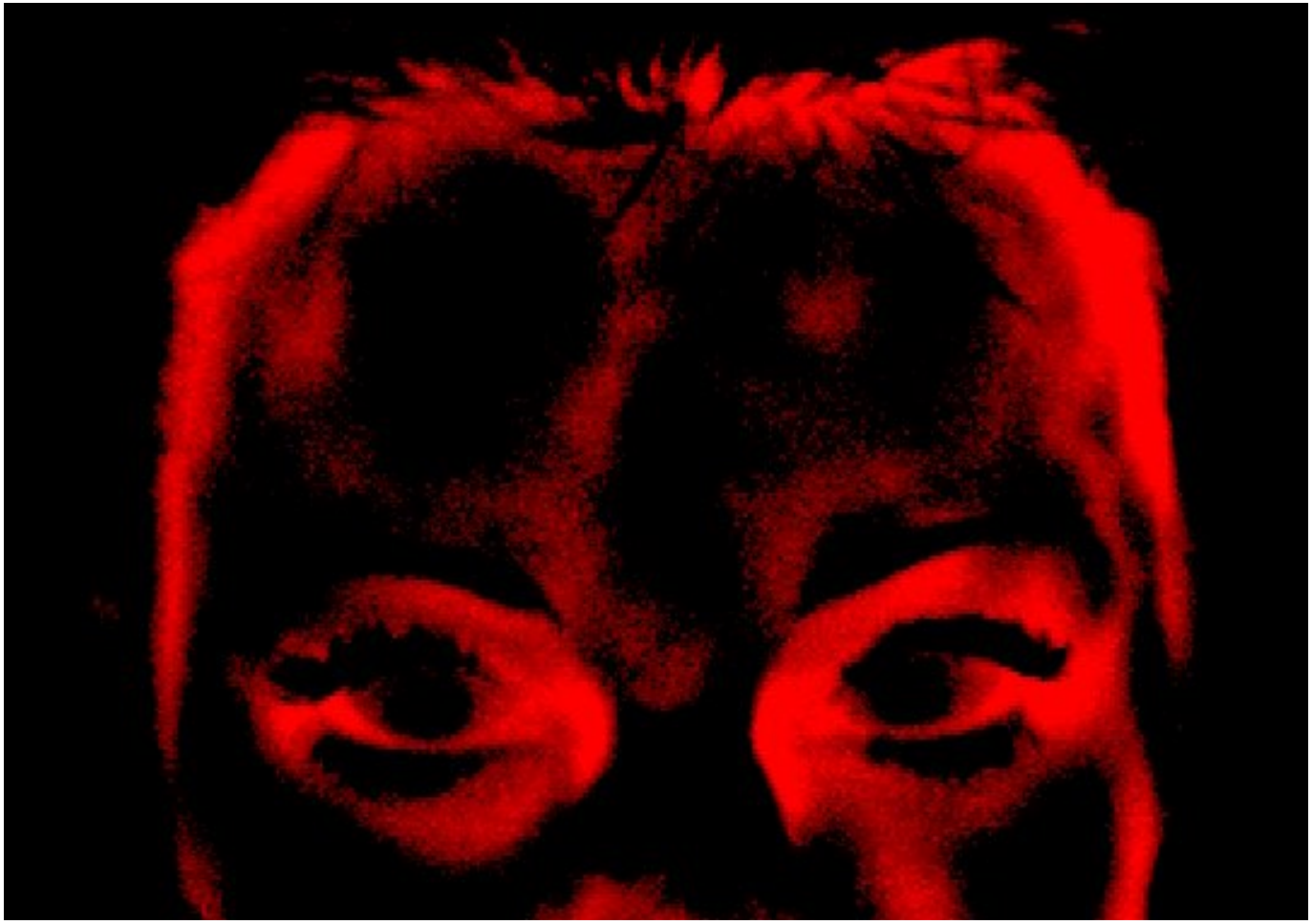


ANGER, SEVERE ADD, POST CONCUSSION, (19yo female)

Same girl after one pIR HEG session ADD symptoms better but not gone.

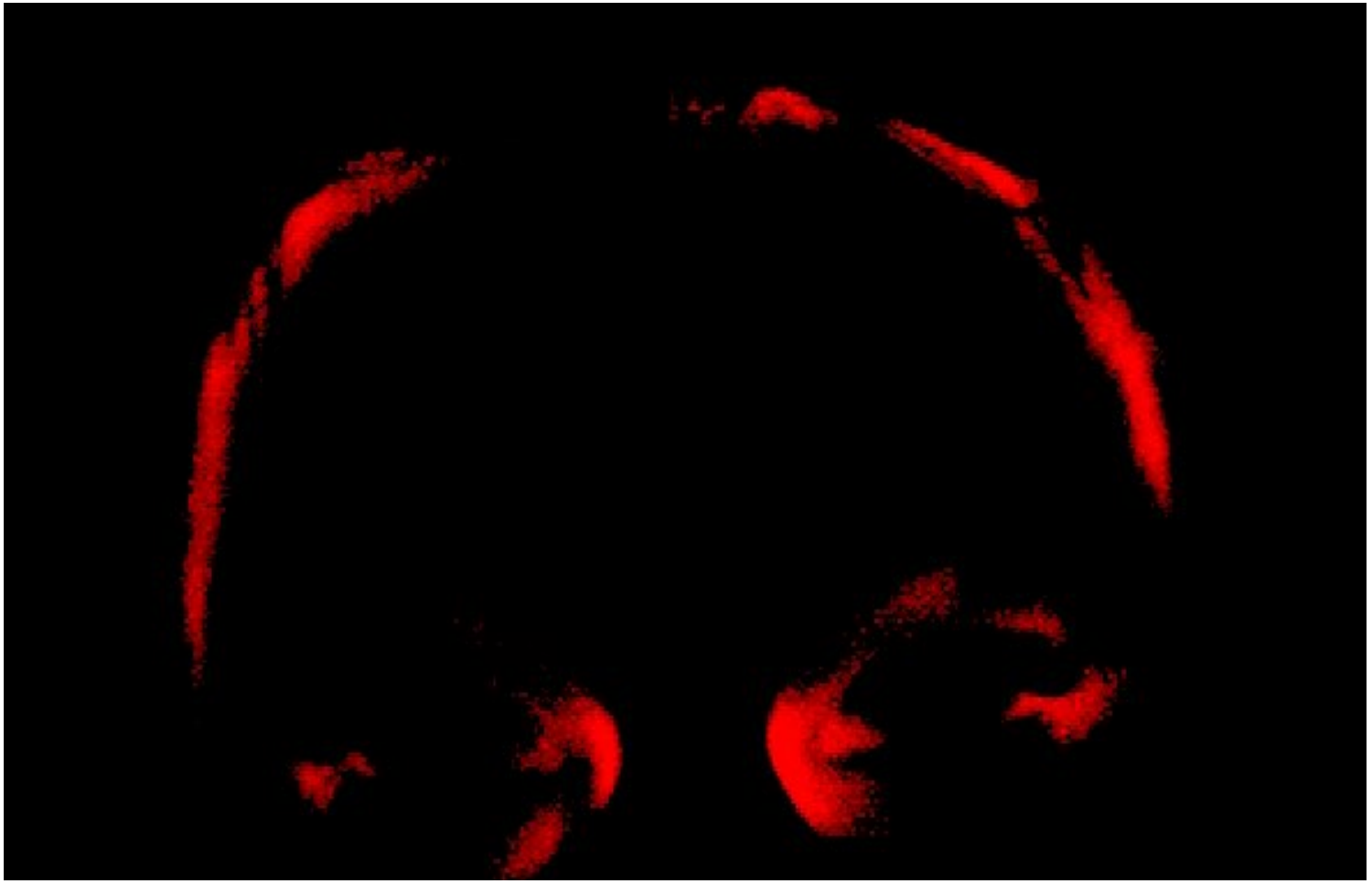


Same girl on stimulant meds
ADD symptoms normalized,
still flares with anger.



Still on stimulants, “you guys are really pissing me off”

“You guys are really pissing me off.”

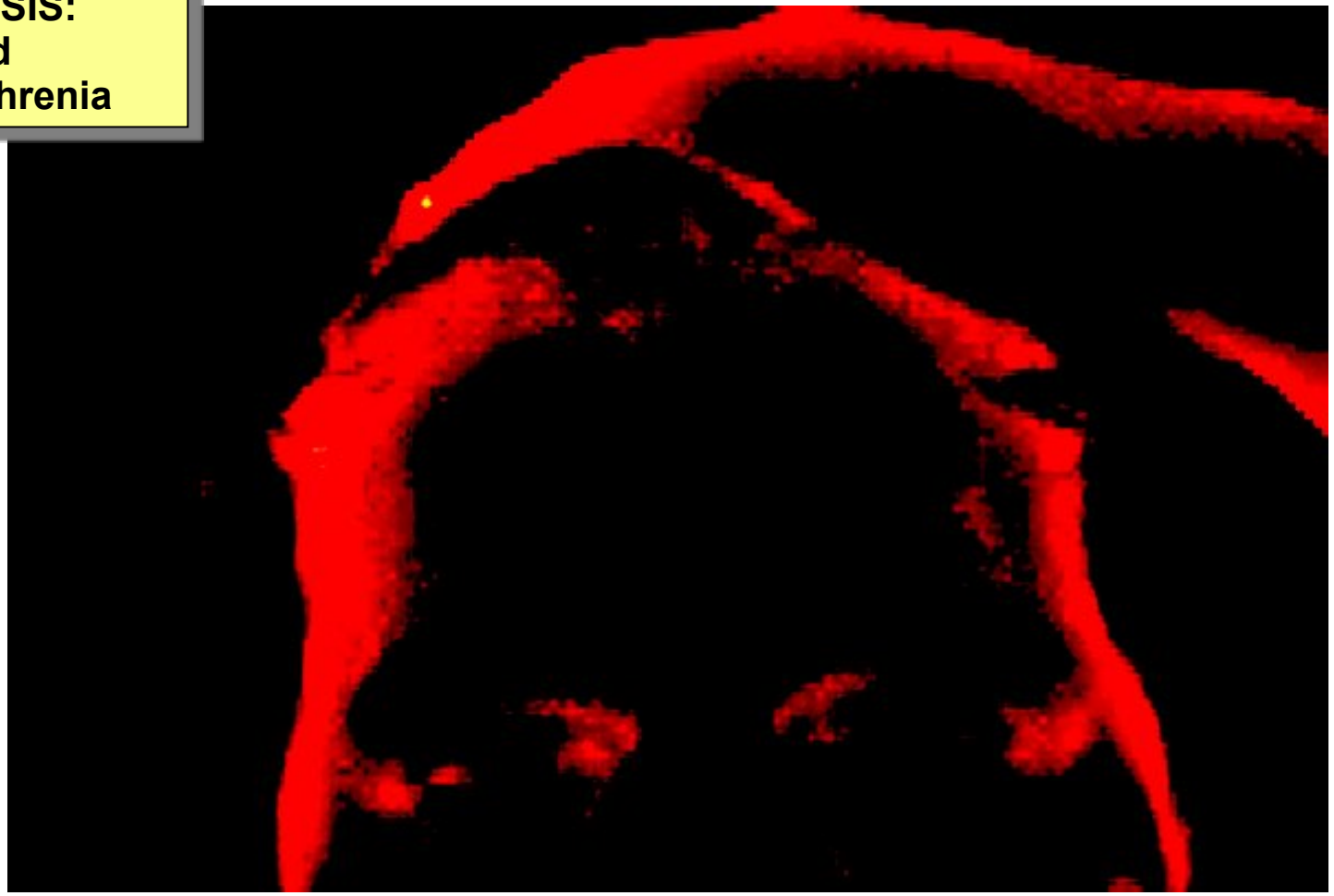


OTHER

CHRONIC ANXIETY, PARANOID DELUSIONS, 21yo male

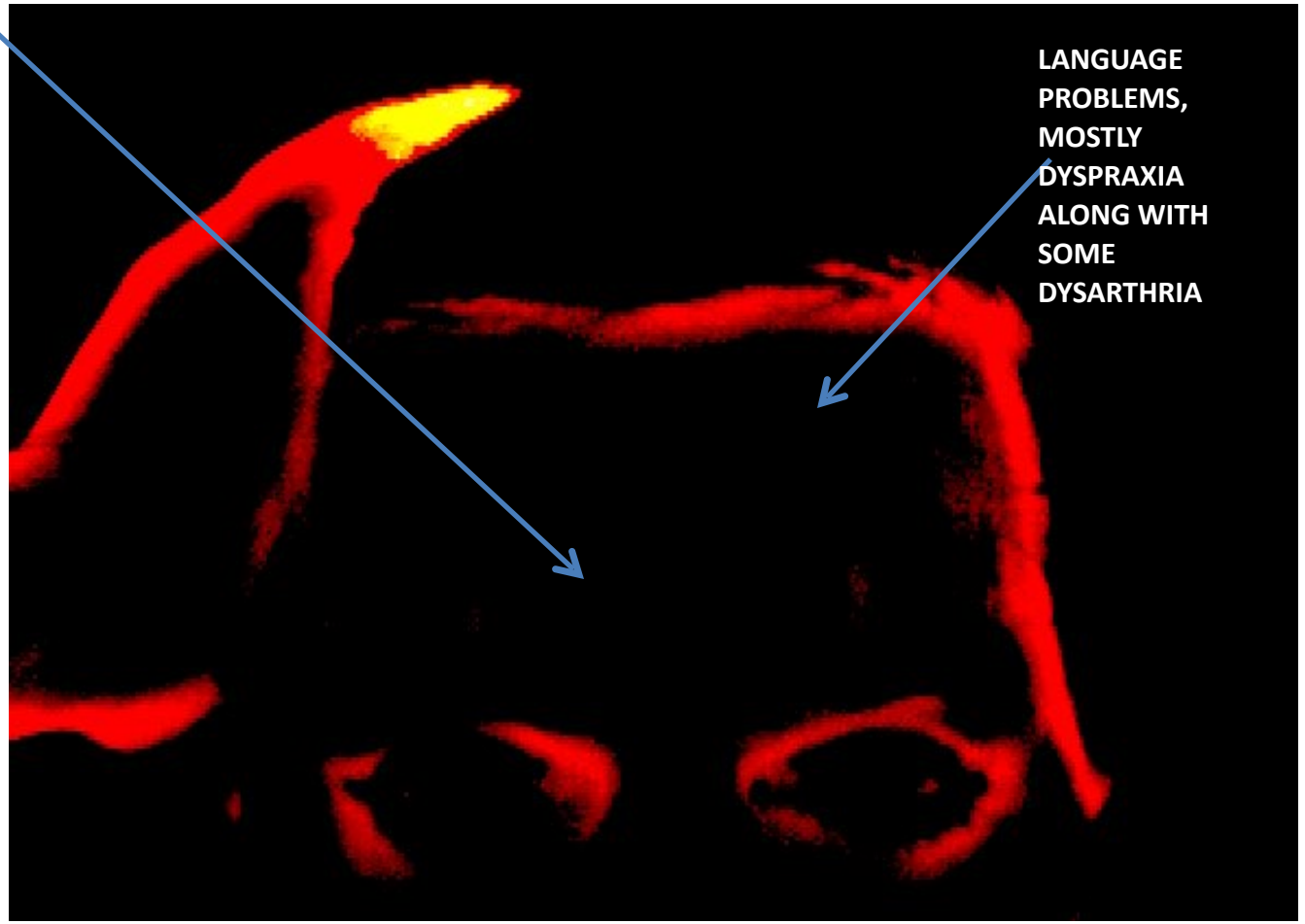
(IR IMAGE LOOKS SIMILAR TO DEPRESSION)

DIAGNOSIS:
Paranoid Schizophrenia



MILD RETARDATION, Attention and language deficit, (20yo male).

ATTENTION PROBLEMS. SHORT SPAN, RAPID SHIFTS OF ATTENTION EVERY 2 TO 3 SECONDS



LANGUAGE PROBLEMS, MOSTLY DYSPRAXIA ALONG WITH SOME DYSARTHRIA

Speech clear, thoughts flow smoothly.

Same fellow after “monthly tuneup”.

IR Image Summary

High variability of the forehead image from hot to cold is generally not a good sign.

Black areas are suggestive of pathology, based on location and size.

Reduction of variability is strongly suggestive of improved functioning.

- Q/A (5 MINUTES) FOR MATERIAL COVERED ON INFRARED IMAGING

SECTION 3

- EXAMPLES OF HOW TO MEASURE PSYCHOLOGICAL AND PHYSIOLOGICAL CHANGE EASILY, AND (SOMETIMES) CHEAPLY.

INFRARED IMAGING

- Yes it is relatively easy.
- Yes it is relatively fast (seconds).
- Cheap? Nope! Costs are maintained relatively high by the target market which is mostly military and industrial.
- Cost: On the low end around $4,800. On the high end, $100,000 and higher.
- Note: The inexpensive cell phone adapters work nicely but are affected by internal heat build-up, so images do not have repeat reliability at body temperatures.

DRAW-A-LINE SLOWLY

- This is a test that I developed for my dissertation. It is based on work that Jerome Kagan was doing at the time involving effort and inhibition, and also the work Karl Pribram was doing on “mental effort”.
- DALS measures the ability to inhibit. Here is how it works: A blank 8.5”x11” sheet of paper is placed vertically in front of the subject. It has 3 small “x” marks placed .5 inch from the top and .5 inch from the bottom, divided evenly across the page.

DRAW-A-LINE SLOWLY

- It meets my criteria for EASY and CHEAP.
- 1. It is easy and fast.
- 2. It is cheap (free).

DALS BLANK FORM

NAME_____ DATE_____ TIME_____

x x x

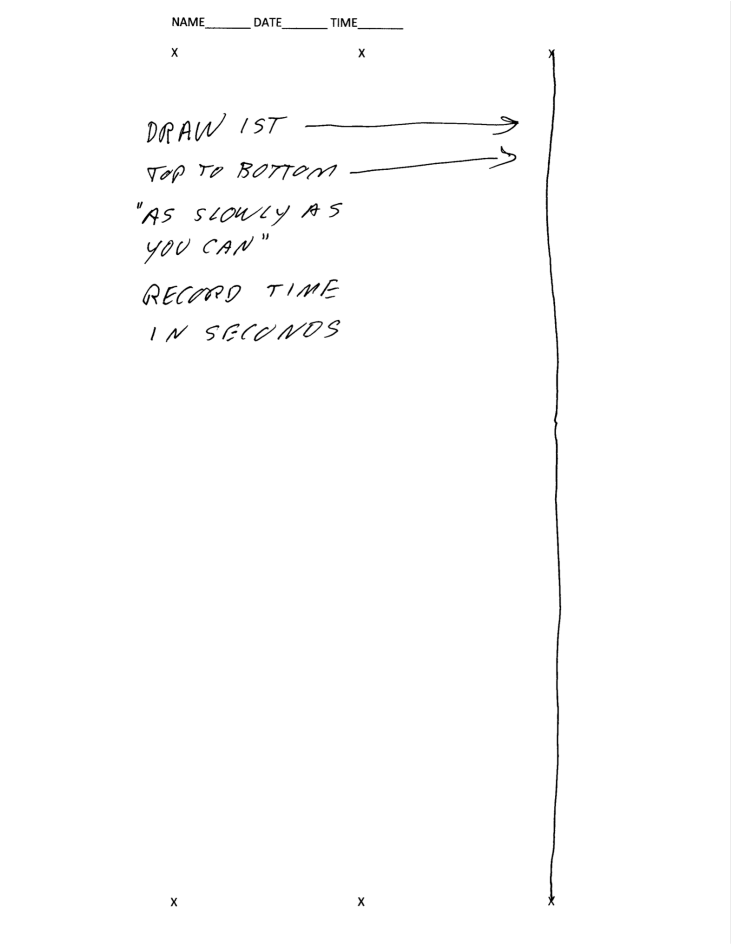
x x x

DALS BLANK FORM

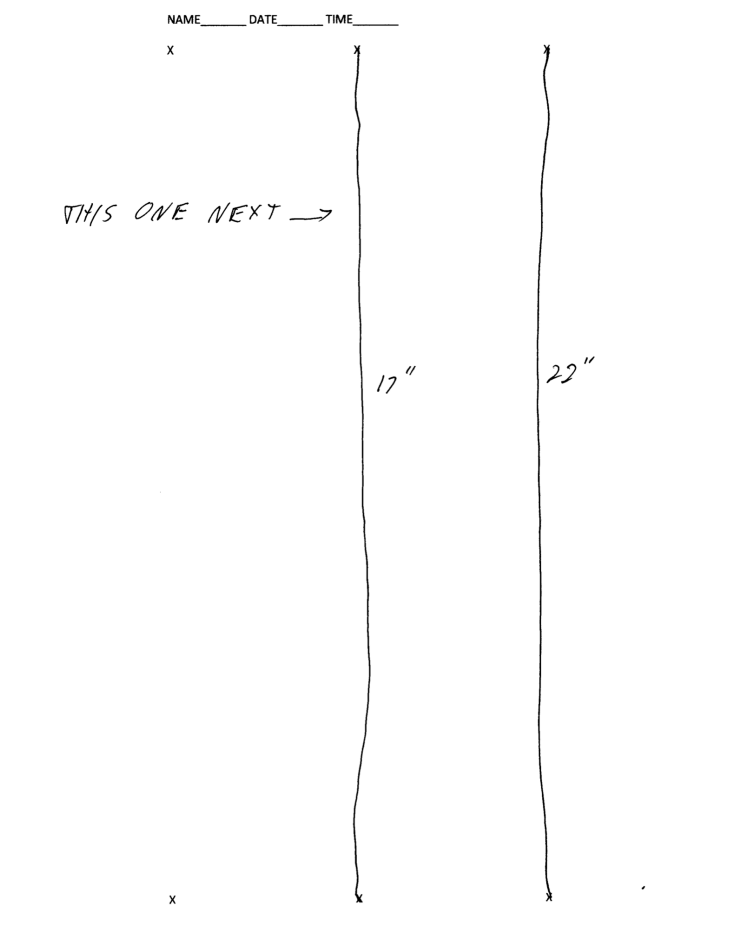
NAME_____ DATE_____ TIME_____

X X X

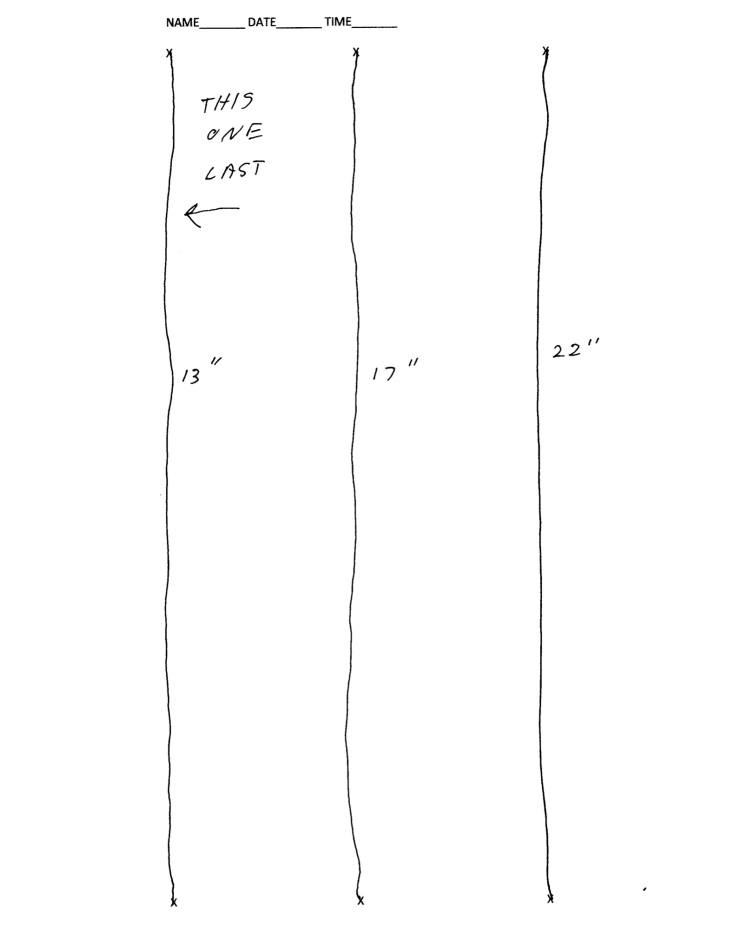
DRAW THE FIRST LINE



DRAW THE SECOND LINE



DRAW THE THIRD LINE



NORMS

- These rough “norms” apply across the age spans from children to adults. They are surprisingly reliable for each individual. For a single individual, repeating the process before and after any sort of session is meaningful in that the numbers have very high repeat reliability. Change strongly suggests real change.
- Session to session baseline change can be interpreted as significant.

NORMS

- Generalizations:
- 1. 20 seconds or less suggests impulsivity / lack of impulse control / lack of inhibition.
- 2. 40 seconds to 120 seconds or more suggests control.
- 3. Kids diagnosed with ADHD tend to draw lines that take less than 20 seconds.
- 4. Each successive line usually takes less time.

NORMS

- Frontal neurofeedback will tend to produce longer times by the end of the session. Stimulant medications have a similar effect. Relaxation training is less predictable.
- DALS can be used as a baseline before each session because the repeat reliability is quite high, and it is fast. The repeat patterns from one session to the next will usually be within a few seconds for each line.

LISTEN/RECORD SPEECH

- Speech is an extremely sensitive neuromuscular mechanism. It doesn't take very much to interfere with clarity. A couple of shots of Scotch or too little sleep will do it.
- It is also very reliable in that for any individual in roughly the same conditions, speech patterns will also be similar.

LISTEN/RECORD SPEECH

- Easy to use? Yes. Just set up an audio recording system. Cell phone, computer, etc.
- Cheap. Yes. Free.
- Normal speech rate is 2 to 3 words per second. Kids diagnosed with ADHD often sound like they are speaking too fast. They are not. The transitions between the phonemes are sloppy.
- Clarity of speech articulation clears up on titrated stimulants or a productive pIR HEG sesstion, and sometimes after a productive EEG sessions.

LISTEN/RECORD SPEECH

- Recordings can be stored for comparison.
- They can be used to tell when a session wears off (# of days).
- With kids, mothers are much more sensitive to noticing these changes than fathers!

PERIPHERAL PHYSIOLOGICAL MEASURES

- SKIN CONDUCTANCE
- This is one of my favorites.
- Cheap? Yes.
- Fast? Yes.
- What does it measure physiologically? A lot less clear than it used to be.
- Fast response to emotions. Can be used to monitor changes in perception of task stress such as measuring reading difficulty.

PERIPHERAL PHYSIOLOGICAL MEASURES

- FINGER TEMPERATURE
- Cheap? Yes.
- Fast? Yes.
- Easy to measure? Yes.
- Meaning? This depends a lot on the individual. You need patterns to help figure it out.
- Traditionally used to treat migraine headaches (for the wrong reasons).

PERIPHERAL PHYSIOLOGICAL MEASURES

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- Traditionally used to treat migraine headaches (for the wrong reasons).

PERIPHERAL PHYSIOLOGICAL MEASURES

- BREATHING RATE
- Cheap? Yes.
- Fast? Yes.
- Meaning? Complicated. Watch for smoothness, excessive rate, hyperventillation.

PERIPHERAL PHYSIOLOGICAL MEASURES

- BLINK RATE
- Cheap? Yes.
- Fast? Yes.
- Meaning. Complex, but blink rate will tend to increase with anxiety and decrease with mental focus.

PERIPHERAL PHYSIOLOGICAL MEASURES

- SQUIRMS PER MINUTE
- Cheap? Yes.
- Fast? Yes.
- Meaning? Not always clear.
- Boys with the hyperactive form of ADHD tend to squirm at about 60 times per minute. But… this also occurs in boys when they are stuck in a chair and don't want to be there.

Which do I like the best?

- I like speech articulation clarity the best. It takes very little to interfere with the clarity of speech articulation. It tends to be one of the first mechanisms to falter with any sort of brain compromise, and one of the last to get better.
- It is very easy to monitor once you get used to listening for speech changes.
- It is very meaningful on an individual basis.

That’s the end!

- Final Q/A.