

Binocular Vision and Seeing God:

## BINOCULAR VISION AND DIPLOPIA: Visual Cues and Seeing God.

'Since I left you mine eye is in my mind  
And that which governs me to go about  
Doth part his function and is partly blind  
The last line confirms this concept  
'My most true mind thus makes mine eye untrue

Shakespeare: Sonnet 113

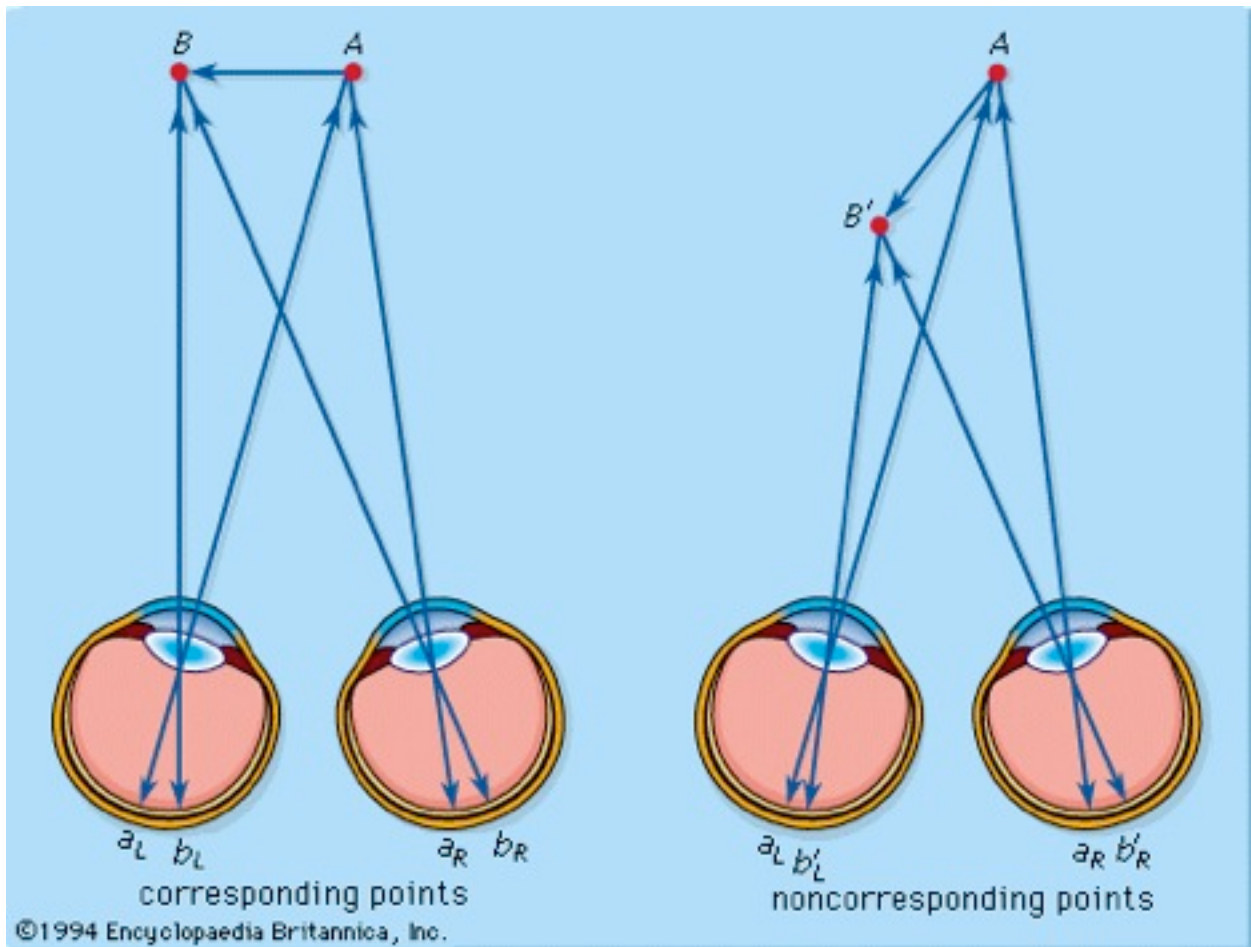
DEMETRIUS: These things seem small and undistinguishable  
Like far-off mountains turned into clouds  
HERMIA: Methinks I see these things with parted eye  
When every thing seems double

A Midsummer Night's Dream Act IV Scene I 92–5

Hughlings Jackson coined the term mental diplopia to describe in the dreamy state of partial complex seizures. The patient recognised his recollections as different from normal memories, being much more vivid and more “satisfactory” but, at the same time was dimly aware of their fictitious character, indicating some preservation of consciousness, thus resulting in the mental diplopia characteristic of the dreamy state.

Jackson HJ: Brain 1888 11:179–207

Binocular Vision and Seeing God:



Definition: Binocular: adj.: the simultaneous use of both eyes, two-eyed or two-sights.

That's just the beginning of the story. When most people hear the word 'binocular' they envision a compact, hand-held, two eyepiece telescope used to watch birds, or whales or whatever. Magnifying and viewing distant objects as if you've been transported there is the function of this optical device. The optical and vision related binocular has a more involved functional definition.

## Stereoscopic imaging and depth perception

Binocular vision requires two views of an object, each seen from a slightly different angle (parallax) combined to form a three dimensional (stereoscopic) (3-D) presentation of that visible space. Our eyes are placed some distance apart, with a divider (the nose) in between, creating the ability to observe two separate images. Our brain combines these images to create a stereoscopic, three dimensional reference. When referring to the human vision system, we call this fused, simultaneous binocular vision. The perception is that of an object-oriented spatially real image.

Recently a team of researchers from the University of Rochester, led by Greg DeAngelis, have fleshed out yet another mechanism of depth perception independent of binocular disparity (published this week in the journal Nature). DeAngelis is quoted as saying:

It looks as though in this area of the brain, the neurons are combining visual cues and non-visual cues to come up with a unique way to determine depth.

This newly discovered method is unique in the interesting way it combines non-visual information to create depth perception. It was previously discovered that the vestibular system may be involved in depth perception. This new study both confirms this and maps out the actual brain areas involved.<sup>1</sup>

Depth perception in humans and other animals can be based on binocular vision, in which the brain compares images from each eye. We can also judge depth with one eye, but how the brain processes the many different cues available for monocular perception of depth is not known. A possible explanation for one cue has now been

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<sup>1</sup> Gregory C. DeAngelis and William T. Newsome

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Neurons selective for binocular disparity are found in a number of visual cortical areas in primates, but there is little evidence that any of these areas are specialized for disparity processing. We have examined the organization of disparity-selective neurons in the middle temporal visual area (MT), an area shown previously to contain an abundance of disparity-sensitive neurons. We recorded extracellularly from MT neurons at regularly spaced intervals along electrode penetrations that passed through MT either normal to the cortical surface or at a shallow oblique angle. Comparison of multiunit and single-unit recordings shows that neurons are clustered in MT according to their disparity selectivity. Across the surface of MT, disparity-selective neurons are found in discrete patches that are separated by regions of MT that exhibit poor disparity tuning. Within disparity-selective patches of MT, we typically observe a smooth progression of preferred disparities (e.g., near to far) as our electrode travels parallel to the cortical surface. In electrode penetrations normal to the cortical surface, on the other hand, MT neurons generally have similar disparity tuning, with little variation from one recording site to the next. Thus disparity-tuned neurons are organized into cortical columns by preferred disparity, and preferred disparity is mapped systematically within larger, disparity-tuned patches of MT. Combined with other recent findings, the data suggest that MT plays an important role in stereoscopic **depth perception** in addition to its well known role in motion **perception**.

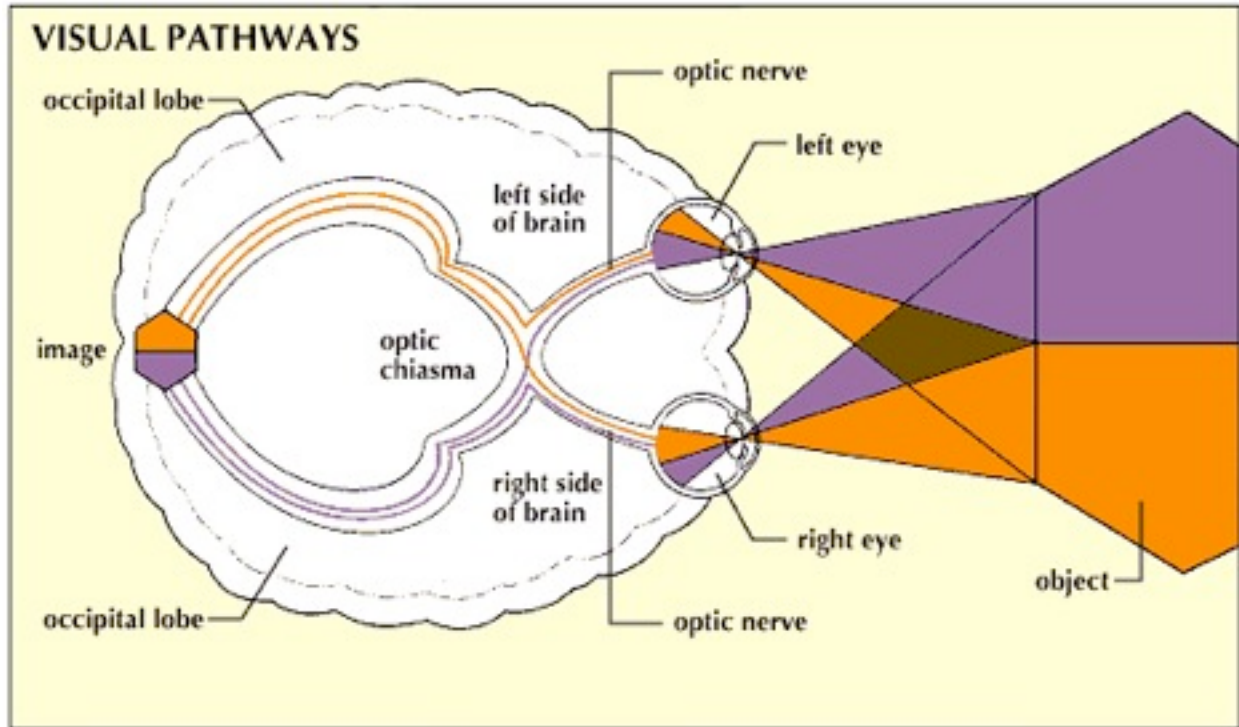
found. The neurons in the middle temporal area of the brain, as well as representing retinal motion, can combine visual information and physical movement to extract depth information from motion parallax, a powerful depth cue that we experience when viewing the scenery from the window of a moving train — objects on the horizon move slowly while the scene close to the train flashes by.

Perception of depth is a fundamental challenge for the visual system, particularly for observers moving through their environment. The brain makes use of multiple visual cues to reconstruct the three-dimensional structure of a scene. One potent cue, motion parallax, frequently arises during translation of the observer because the images of objects at different distances move across the retina with different velocities. Human psychophysical studies have demonstrated that motion parallax can be a powerful depth cue [1](#), [2](#), [3](#), [4](#), [5](#), and motion parallax seems to be heavily exploited by animal species that lack highly developed binocular vision [6](#), [7](#), [8](#). However, little is known about the neural mechanisms that underlie this capacity. Here we show, by using a virtual-reality system to translate macaque monkeys (*Macaca mulatta*) while they viewed motion parallax displays that simulated objects at different depths, that many neurons in the middle temporal area (area MT) signal the sign of depth (near versus far) from motion parallax in the absence of other depth cues. To achieve this, neurons must combine visual motion with extra-retinal (non-visual) signals related to the animal's movement. Our findings suggest a new neural substrate for depth perception and demonstrate a robust interaction of visual and non-visual cues in area MT. Combined with previous studies that implicate area MT in depth perception based on binocular disparities our results suggest that area MT contains a more general representation of three-dimensional space that makes use of multiple cues.<sup>2</sup>

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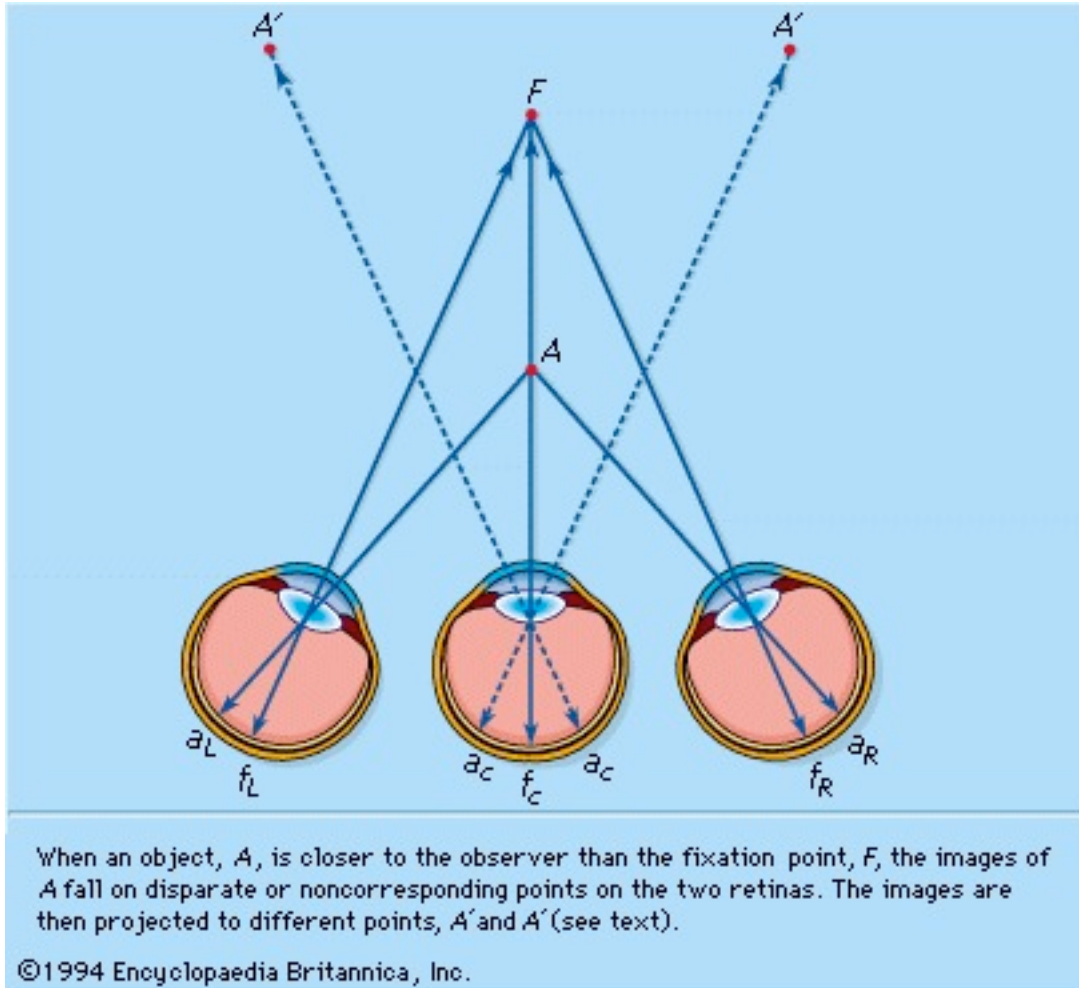
<sup>2</sup> A neural representation of depth from motion parallax in macaque visual cortex Jacob W. Nadler, Dora E. Angelaki & Gregory C. DeAngelis

## Binocular Vision and Seeing God:



The optic nerve connects the retina to the visual cortex in the back of the brain. Increased intracranial pressure, tumours, and increased vascular pressure in the eye are possible mechanisms by which the optic nerve can become damaged, impairing vision

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Diplopia occurs when the visual axes become misaligned, causing the image of an object to fall on non corresponding areas of the retina of each eye. This causes the perception of two images instead of one.

Diplopia causes the person to see double images instead of a single image.

Binocular vision gives us for the main part depth perception and peripheral vision.<sup>3</sup>

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<sup>3</sup> However for recent theories deconstructing these long held views see "The Vision Revolution: How the Latest Research Overturns Everything We Thought We Knew About Human Vision" [Mark Changizi](#) :Benbella Books 2009

Binocular Vision and Seeing God:

This neurological introduction will inform the way we read the follow enigmatic text regarding the Biblical command to appear before the Lord in the Temple in Jerusalem.

Three times a year shall all your males appear before the Lord your God in the place which He shall choose; in the feast of unleavened bread, and in the feast of weeks, and in the feast of booths: and they shall not appear before the Lord empty. (Deut. 16:16)

The Text in Exodus states as follows:

Three times in the year all your males shall appear (yera'e) before the Lord God. (Shemot 23:17)

Chazal interpreted the keri and the ketiv — the way the word is read and the way it is written – of the word yera'e as follows:

Yir'e – Yera'e: As he comes to see, so he comes to be seen. (Talmud Chagiga 2a)<sup>4</sup>

And Rashi explains:

The word is written yir'e, but we read it as yera'e. "All your males shall see (yir'e) the Lord God" - implying that man sees the Shekhina. "[All your males] shall appear (yera'e) before the Lord God" – implying that the Lord comes to see you.

Lehera'ot – to be seen: According to the simple understanding, the mitzva of the pilgrimage is to be seen, that is to say, that God should see us. The basis for this – and apparently the basis for the aforementioned derasha in Chagiga – is what is stated in the Akeida story:

And Avraham called the name of that place Ad-onai-Yir'e: as it is said to this day, In the mount the Lord will appear (yera'e). (Bereishit 22:14)

Avraham's intention in calling the place Ad-onai Yir'e was "God will choose this place," as the Torah states:

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#### **4 1) MISHNAH: WHO IS OBLIGATED IN "RE'IYAH"**

Beis Shamai and Beis Hillel argue what is the minimum values of the Korban Re'iyah and Korban Chagigah (2 Me'os or 1 Me'ah).

#### **2) WHOM THE MISHNAH IS INCLUDING IN THE OBLIGATION**

(a) Whom does the word "all" in the Mishnah include?

(b)1. It includes either one who was lame on the first day of Yom Tov but became well on the next day.

2. Or it includes one **who is blind in one eye**.

3. Or it includes one who is half slave and half free.

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But to the place which the Lord your God shall choose out of all your tribes to put His name there, there shall you seek Him, at His dwelling, and there shall you come. (Devarim 12:5)

According to this, it is possible that the objective of the mitzva of making a pilgrimage is to be appear before God three times a year in order to be chosen by Him anew, that is, in order that He reconfirm His choosing of us.<sup>5</sup>

Of great interest to me is why is a blind person in one eye exempt from this most important commandment to appear before the Lord in the Holy Temple?

Talmud Chagigah 4a:

R. Johanan b. Dahabai said in the name of R. Judah: A person who is blind in one eye is exempt from appearing [at the Temple]. for it is said: Yir'eh[He shall see Ex 10:23], Yera'eh [He shall be seen]; just as He comes to see, so He comes to be seen; as He comes to see with both eyes. so also to be seen with both eyes.

R. Huna, when he came to this verse, Yir'eh, Yera'eh, wept. He said: The slave whom his Master longs to see should become estranged from him! For it is written: When ye come to appear before Me, who hath required this at your hand, to trample My courts? (Isa 1:12)

It appears that just as God has two eyes so we must appear with two eyes! What does this gross anthropomorphism mean to teach us? And why exclude those unfortunates who suffered the loss of one of their eyes?

Clearly our excursus into neurology exposed the benefit of binocular vision. Depth perception and peripheral field vision allows for the organism or see beyond the facts and into the truth. Depth perception refuses to allow a cursory and surface level of reading. It allows for deep penetrating vision as well as the side glance and periphery. Things passing on the sides of vision can be seen whereas ordinarily missed.

In seeing this way we are being told that to see God and be seen by god requires this kind of depth perception and peripheral filed. In turn God sees us in the same way overlooking our surface flaws and deep into the soul of every devotee.

We are also being taught that often seeing God can only be accomplished by a glance in the periphery never head on. Man cannot see the divine head on, like the sun. However a glance is possible from the periphery, seeing the passing of the Divine in our lives is possible as did Moses in the cleft of the rock

Exodus 33:18 And he said, I beg you, show me your glory. 19 And he said, I will make all my goodness pass before you, and I will proclaim the name of the Lord before you; and will be gracious to whom I will be gracious, and will show mercy on whom I will

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<sup>5</sup> Pilgrimages, Pesach and Yom Kippur: Rav Yitzchak Levi, VBM Torah

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show mercy. 20 And he said, You can not see my face; for no man shall see me and live. 21 And the Lord said, Behold, there is a place by me, and you shall stand upon a rock; 22 And it shall come to pass, while my glory passes by, that I will put you in a cleft of the rock, and will cover you with my hand while I pass by; 23 And I will take away my hand, and you shall see my back; but my face shall not be seen.

In our lives we see His presence only in the periphery in the past and in the most unexpected places. Reb Nachman had already taught this when claiming that the divine must hide in unexpected places and times so that the forces of the Other Side will remain unaware.<sup>6</sup>

When it comes to pathological vision the reverse is true as we shall discover in another pericope in Genesis where we are told of the two trees in the Garden of Eden:

Diplopia in the Garden of Eden

Gen 2: 9 “And out of the ground made the Lord God every tree to grow that is pleasant to the sight, and good for food; the tree of life also in the midst<sup>7</sup> of the garden, and the tree of knowledge of good and evil.”

The text is quite ambiguous as to the exact nature of what was in the middle of the garden.

Gen 2:16 “And the Lord God commanded the man, saying, Of every tree of the garden you may freely eat; But of the tree of the knowledge of good and evil, you shall not eat of it; for in the day that you eat of it you shall surely die.”

The command is quite clear the difference between the two trees is clear and the identification of the proscribed tree is clear.

Gen 3:1 “Now the serpent was more subtle than any beast of the field which the Lord God had made. And he said to the woman, Has God said, you shall not eat of every tree of the garden? 2 And the woman said to the serpent, We may eat of the fruit of the trees of the garden; 3 But of the fruit of the tree which is in the midst of the garden, God has said, you shall not eat of it, nor shall you touch it, lest you die. 4 And the serpent said to the woman, surely you shall not die; 5 For God knows that in the day you eat of it, then your eyes shall be opened, and you shall be as gods, knowing good and evil.”

The woman knew which of the trees was prohibited but the narrator does not identify

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<sup>6</sup> See Liketui Nehoran

<sup>7</sup> The hebrew *betoch* could either mean ‘in the middle of’, or merely ‘within’, but Rashi states in the middle: *be-emtza*

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which of the two trees was prohibited.

The Beis Yaakov of Radzin suggests there was only one tree in the midst of the garden. There can only be one tree in the mid point of a circle.

From man's perspective there are two trees because he suffers from spiritual diplopia. This double vision splits reality into life and knowledge, forever cursing him to suffer the either/or effect of experiencing versus knowing. The Hebrew word for inner experience is daas meaning to know from the inside as in Biblical knowing or marital relations. After tasting the fruit of the forbidden tree man was condemned to split between experiential knowledge in the body and intellectual knowledge in the mind.

This affects all areas of life where at some point there is always a split and a disconnect between the reality as perceived and the reality as experienced.

The story from the Garden points to the pathological disorder of diplopia whereas the story of the temple offering reveals the need for two eyes and depth perception.

I think these two stories mirror each other.

In the appearance with binocular vision we are being asked to see beyond the facts and the literal reading to a depth perception of truth, beyond the facts and into the truth. (I claim that nigleh is factual talmud is concerned with facts whereas the secrets of Torah or nistar is about truth)

In our failure to integrate experience and knowledge we tend to split reality and never become aware of life in the body, somatically because of this flaw.

Embodiment is most fully experienced in daas the intimate experience of another. After the sin Adam supposedly was separate from his wife for 130 years and returning his daas was flawed. Rash comments on the verse "and Adam knew his wife again (od) and they bore a son..." (Gen 4:25) the meaning of the word again is to teach you that he added desire upon desire. The very knowing her again was different. This kind of knowing caused him to intellectualize the intimacy so that it became pornographic in his mind. The splitting between body and mind, between actual somatic experience of intimacy and the obsessional images that could not leave him was now complete.

To be seen by God in the Temple required binocular vision so that He too could see beyond our facts and the truth of us. Our flaw in splitting between the two trees in the garden, our spiritual diplopia reflected the very splitting of our souls into the discursive and the experiential. There could only be one tree in the middle of the garden, the tree of life. The other tree comes with splitting between good and evil and between the whole notion of morality and life itself. The Beis Yak concludes that once man has refined himself the two combine:

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“From the divine perspective there was only the tree of life in the middle of the Garden. For the tree of knowledge of good and evil is associated with the name Elohim (whereas the tree of Life is associated with the name of the tetragrammaton). In truth there is only one tree in the garden however in this world which is a world of doubt, the (function of this) tree is the tree of knowledge of good and evil. But above the tree of knowledge is the tree of life. If a man refines himself in the fear of God, and merits the radiance of the divine light of the tetragrammaton, then the two are one”.

This spiritual diplopia is the very foundation of man’s expulsion from the garden and our current alienation from our true selves.

The healing is in the spiritual practices devoted to resolving the split between the heart and the mind, Torah and tefillah as outlined by the Hassidic Masters.