

Access Concentration and Jhana Training from the Visuddhimagga

Michael Hagerty
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Abstract: The Visuddhimagga is the ancient instruction manual for all Buddhist meditation teachers. We review the 300 pages devoted to instructions on reaching access concentration and jhana, focusing our search for clues to any physiological or psychological processes known to current science. We develop 9 hypotheses on why the ancient instructions may initiate the altered states of access concentration and jhana, and relate effects known to current science that may account for some of the effects documented in the Visuddhimagga. We close by identifying two training mechanisms that current science suggests would accelerate training in mindfulness and “whole brain integration.”

The Visuddhimagga (1991) is the ancient instruction manual for Buddhist teachers of meditation. It was written sometime in the fifth century but is a compendium of many earlier manuscripts. It continues to be the authoritative source for masters of Buddhist meditation. It describes the development of advanced concentration techniques that culminate in the altered state of intense joy called jhanas.

The Visuddhimagga enumerates 40 different objects of meditation that can lead to jhana (Visu. III, 104): 10 kasinas (visible objects including earth, water, fire, air, blue, yellow, red, white, light, and limited space), 10 meditations on dead bodies and rotting corpses (no longer practiced because of public health laws), 10 recollections (of the Buddha, the Dharma, Mindfulness of Breathing, etc.), 4 divine abidings (lovingkindness, compassion, joy, and equanimity), 4 immaterial states, one perception and one defining. Each object of meditation gives rise to several “signs” as the meditation develops. The first sign is simply the visual image of the object. With practice this sign can be viewed with eyes closed (without the material input of the eye required), though it retains imperfections of the material realm (asymmetry, imperfect color, etc.). This is called the “learning sign” (Visu IV 31). Finally with continuing practice the imperfections disappear, and the perfect “counterpart sign” is seen, first with eyes closed, and in master practitioners with eyes open. Once this counterpart sign is apprehended, access concentration has been attained. Jhana is attained simply by remaining in access concentration for long periods of time. Details from crucial chapters follow, with many direct quotes from the Visuddhimagga in order to give a sense of its instructional method for concentration.

Quotations from the Visuddhimagga

1. Earth Kasina: Of the 10 visual kasinas, the Visuddhimagga goes into most detail on the first or Earth kasina. First, one must sever the “lesser impediments”, shaving the head, bathing, mending old robes, bed and chair to be cleaned. Then detailed instructions are given for making an Earth kasina, using clay of an earth color [not yellow or red, but the color of dawn or grey], about the size of a bushel, seating “himself on a well-covered chair with legs a span and four fingers high, prepared in a place that is two and a half cubits (two and a half times elbow to finger-tip) from the kasina disk. For the kasina

does not appear plainly to him if he sits further off that that. And if he sits nearer than that, faults in the kasina appear.” (Visu IV, 26).

Visu IV 27: “So, after seating himself in the way stated, he should review the dangers in sense desires in the way beginning, ‘Sense desires give little enjoyment’ and arouse longing for the escape from sense desires, for the renunciation that is the means to the surmounting of all suffering. He should next arouse joy of happiness by recollecting the special qualities of the Buddha, the Dhamma, and the Sangha; then awe by thinking ‘Now this is the way of renunciation entered upon by all Buddhas, Paccekabuddhas, and noble disciples’; and then eagerness by thinking ‘In this way I shall surely come to know the taste of the bliss of seclusion. After that he should open his eyes moderately, apprehend the sign, and so proceed to develop it. If he opens his eyes too wide, they get fatigued and the disk becomes too obvious, which prevents the sign becoming apparent to him. If he opens them too little, the disk is not obvious enough, and his mind becomes drowsy, which also prevents the sign from becoming apparent to him. So he should develop it by apprehending the sign (nimitta), keeping his eyes moderately open, as if he were seeing the reflection of his face on the surface of a looking-glass...”

Attention should be given not to the color but to the name, repeated often, of “Earth, Earth.”

Visu IV 29: “It should be adverted to now with eyes open, now with eyes shut. And he should go on developing it in this way a hundred times, a thousand times, and even more than that, until the learning sign arises.

When, while he is developing it in this way, it comes into focus as he adverts with his eyes shut exactly as it does with his eyes open, then the learning sign is said to have been produced. After its production he should no longer sit in that place; he should return to his own quarters and go on developing it sitting there. But in order to avoid the delay of foot washing, a pair of single-soled sandals and a walking stick are desirable. Then if the new concentration vanishes through some unsuitable encounter, he can put his sandals on, taking his walking stick, and go back to the place to reapprehend the sign there. When he returns he should seat himself comfortably and develop it by reiterated reaction to it and by striking at it with thought and applied thought.

Visu IV 31: “As he does so, the hindrances eventually become suppressed, the defilements subside, the mind becomes concentrated with access concentration and the counterpart sign arises.

The difference between the earlier learning sign and the counterpart sign is this. In the learning sign any fault in the kasina is apparent. But the counterpart sign appears as if breaking out from the learning sign, and a hundred times, a thousand times more purified, like a looking-glass disk drawn from its case, like a mother of pearl dish well washed, like the moon’s disk coming out from behind a cloud, like cranes against a thunder cloud. But it has neither color nor shape; for if it had, it would be cognizable by the eye, gross, susceptible of comprehension and stamped with the three characteristics. But it is not like that. For it is born only of perception in one who has obtained concentration, being a mere mode of appearance. But as soon as it arises the hindrances are quite suppressed, the defilements subside, and the mind becomes concentrated in access concentration.”

Visu IV 126: “Extension of the Sign: In order to perfect the development of consciousness he should besides extend the counterpart sign according as acquired... The

way to extend it is this. The meditator should not extend the sign as a clay bowl or a cake or boiled rice or a creeper or a piece of cloth is extended. He should first delimit with his mind successive sizes for the sign, according as acquired, that is to say, one finger, two fingers, three fingers, four fingers, and then extend it by the amount delimited, just as a ploughman delimits with the plough the area to be ploughed and then ploughs within the area delimited.

2. *Fire Kasina*: One should make a fire but not view the entire scene. Instead, “He should make a hole a span and 4 fingers wide in a rush mat or a piece of leather or a cloth, and after hanging it in front of the fire, he should sit down in the way already described. Instead of giving attention to the grass and sticks below or the smoke above, he should apprehend the sign in the dense combustion in the middle. He should not review the color as blue or yellow, etc., or give attention to its characteristic as heat, etc.” but should set his mind on the name “fire, fire.”

“As he develops it in this way the two signs eventually arise in him as already described. Herein, the learning sign appears like the fire sinking down as the flame keeps detaching itself... The counterpart sign appears motionless like a piece of red cloth set in space, like a gold fan, like a gold column. With its appearance he reaches access jhana and the jhana tetrad...” (Visu IV 8).

3. *Light Kasina*: “He can light a lamp inside a pot, close the pot’s mouth, make a hole in it and place it with the hole facing the wall. The lamplight coming out of the hold throws a circle on the wall. He should develop that as “light, light.” This lasts longer than the other kinds. Here the learning sign is like a circle thrown on the wall or the ground. The counterpart sign is like a compact bright cluster of light.” (Visu IV 23).

4. *Ten Kinds of Skills in Absorption*: (Visu IV 42): “Skill in absorption needs ten aspects: (1) making the basis clean [cleaning the body, the robes, and the lodging], (2) maintaining balanced faculties [balancing faith with energy, mindfulness, concentration, and understanding], (3) skill in [protecting] the sign [once it is developed] (4) exerting the mind on an occasion when it should be exerted [When his mind is slack with over-laxness of energy, etc., then instead of developing the three enlightenment factors beginning with tranquility, he should develop the remaining factors: investigation-of-states [which states are profitable and skillful and which are not], the energy enlightenment factor, and the happiness enlightenment factor], (5) restraining the mind on an occasion when it should be restrained [When his mind is agitated through over-energeticness, etc. then, instead of developing the last 3 factors, he should develop tranquility [seven things lead to the arising of the tranquility enlightenment factor: using superior food, living in a good climate, maintaining a pleasant posture, keeping to the middle, avoidance of violent persons, cultivation of persons tranquil in body, and resoluteness upon tranquility.] (6) encouraging the mind on an occasion when it should be encouraged [when the mind is listless, then he should stimulate it by reviewing the eight grounds for a sense of urgency (birth, ageing, sickness, death, suffering of the states of loss, suffering in the past rooted in rebirth, suffering in the future rooted in rebirth, and suffering in the present rooted in search for nutriment]. (7) look on at the mind with equanimity on an occasion when it should be looked on with equanimity [when he is

serene, unidle, unagitated and not listless], (8) avoidance of unconcentrated persons, (9) cultivation of concentrated persons, and (10) resoluteness upon concentration.

5. Mindfulness of Breathing: Despite being the most-taught method of access-concentration at present, mindfulness of breathing is the 29th of the 40 objects of meditation, and doesn't even have its own category, being lumped with the 10 "recollections." And it is said to be the most difficult object: "this mindfulness of breathing is difficult, difficult to develop, a field in which only the minds of Buddhas, Paccekabuddhas, and Buddhas' sons are at home." The reason is that "while other meditation subjects become clearer at each higher stage, this one does not: in fact as he goes on developing it, it becomes more subtle for him at each higher stage, and it even comes to the point at which it [the breath] is no longer manifest" (Visu VIII, 208).

Twenty-five pages of instructions are given by unpacking the short description of breathing meditation given by the Buddha in the famous Anipanasati Sutta:

Anapanasati Sutta: "There is the case where a monk, having gone to the wilderness, to the shade of a tree, or to an empty building, sits down folding his legs crosswise, holding his body erect, and setting mindfulness to the fore. Always mindful, he breathes in; mindful he breathes out." Breathing in long, he discerns, 'I am breathing in long'; or breathing out long, he discerns, 'I am breathing out long.' Or breathing in short, he discerns, 'I am breathing in short'; or breathing out short, he discerns, 'I am breathing out short.' He trains himself, 'I will breathe in sensitive to the entire body.' He trains himself, 'I will breathe out sensitive to the entire body.' He trains himself, 'I will breathe in calming bodily fabrication.' He trains himself, 'I will breathe out calming the bodily fabrication.' "He trains himself, 'I will breathe in sensitive to rapture.' He trains himself, 'I will breathe out sensitive to rapture.' He trains himself, 'I will breathe in sensitive to pleasure.' He trains himself, 'I will breathe out sensitive to pleasure.' He trains himself, 'I will breathe in sensitive to mental fabrication.' He trains himself, 'I will breathe out sensitive to mental fabrication.' He trains himself, 'I will breathe in calming mental fabrication.' He trains himself, 'I will breathe out calming mental fabrication.'" He trains himself, 'I will breathe in sensitive to the mind.' He trains himself, 'I will breathe out sensitive to the mind.' He trains himself, 'I will breathe in satisfying the mind.' He trains himself, 'I will breathe out satisfying the mind.' He trains himself, 'I will breathe in steadying the mind.' He trains himself, 'I will breathe out steadying the mind.' He trains himself, 'I will breathe in releasing the mind.' He trains himself, 'I will breathe out releasing the mind.'" He trains himself, 'I will breathe in focusing on inconstancy.' He trains himself, 'I will breathe out focusing on inconstancy.' He trains himself, 'I will breathe in focusing on dispassion [*literally*, fading].' He trains himself, 'I will breathe out focusing on dispassion.' He trains himself, 'I will breathe in focusing on cessation.' He trains himself, 'I will breathe out focusing on cessation.' He trains himself, 'I will breathe in focusing on relinquishment.' He trains himself, 'I will breathe out focusing on relinquishment.'" "This is how mindfulness of in-&-out breathing is developed & pursued so as to be of great fruit, of great benefit."

The famous Sutta is unpacked in the Visuddhimagga as: “Herein, crosswise is the sitting position with the thighs fully locked. ‘Set his body erect’: having placed the upper part of the body erect with the eighteen backbones resting end to end. For when he is seated like this, his skin, flesh, and sinews are not twisted and so the feelings that would arise moment by moment if they were twisted do not arise.

“And in the case of human beings some breathe in and breathe out long, by extent of time, as elephants, snakes, etc. do, while others breathe in and breathe out short in that way as dogs, hares, etc. do. Of these, therefore, the breaths that travel over a long extent in entering in and going out are to be understood as long in time; and the breaths that travel over a little extent in entering in and going out, as short in time. Mindfulness is established in nine ways:

“How, breathing in long, does he know: ‘I breathe in long,’ breathing out long, does he know: ‘I breathe out long’? (1) He breathes in a long in-breath reckoned as an extent. (2) He breathes out a long out-breath reckoned as an extent. (3) He breathes in and breathes out long in-breaths and long out-breaths reckoned as an extent. As he breathes in and breathes out long in-breaths and out-breaths reckoned as an extent, zeal arises. (4) Through zeal he breathes in a long-in-breath more subtle than before reckoned as an extent. (5) Through zeal he breathes out a long out-breath more subtle than before reckoned as an extent. (6) Through zeal he breathes in and breathes out long in-breaths and out-breaths more subtle than before reckoned as an extent. As, through zeal, he breathes in and breathes out long in-breaths and out-breaths more subtle than before reckoned as an extent, gladness arises. (7) Through gladness he breathes in a long-in-breath more subtle than before reckoned as an extent. (8) Through gladness he breathes out a long out-breath more subtle than before reckoned as an extent. (9) Through gladness he breathes in and breathes out long in-breaths and out-breaths more subtle than before reckoned as an extent. As, through gladness, he breathes in and breathes out long in-breaths and out-breaths more subtle than before reckoned as an extent, his mind turns away from the long in-breaths and out-breaths and equanimity is established. (Visu VIII, 168.)

Unpacking Buddha’s phrase “I shall breathe in...I shall breathe out experiencing the whole body,” the Visuddhimagga says “I shall breathe in making known, making plain, the beginning, middle and end of the entire in-breath body.” In developing his practice, “he should only breathe in and breathe out and not do anything else at all, and it is only afterwards that he should apply himself to the arousing of knowledge by saying “I shall breathe in, shall breathe out tranquillizing, completely tranquillizing, stopping, stilling, the gross bodily formation. And here both the gross and subtle state and also progressive tranquilizing should be understood. For previously, at the time when the bhikkhu has still not discerned the meditation subject, his body and his mind are disturbed and so they are gross. And while the grossness of the body and the mind has still not subsided the in-breaths and out-breaths are gross. They get stronger; his nostrils become inadequate, and he keeps breathing in and out through his mouth. But they become quiet and still when his body and mind have been discerned. When they are still then the in-breaths and out-breaths occur so subtly that he has to investigate whether they exist or not. (Visu VIII 176). By the fourth jhana, they believe that the breath ceases altogether (Visu VIII 179). “Just as when a gong is struck. At first gross sounds occur and consciousness occurs because the sign of the gross sounds is well apprehended, well

attended to, well observed; and when the gross sounds have ceased, then afterwards faint sounds occur and consciousness occurs because the sign of the faint sounds is well apprehended, well attended to, well observed; and when the faint sounds have ceased, then afterwards consciousness occurs because it has the sign of the faint sounds as its object – so too, at first gross in-breaths and out-breaths occur...then afterwards consciousness does not become distracted because it has the sign of the faint in-breaths as its object.

Eight stages are cited in the process of learning mindfulness of breathing: (1) counting, (2) connection, (3) touching, (4) fixing, (5) observing, (6) turning away, (7) purification, and (8) looking back on these. (1) Counting means he should silently count each breath “one, one” after the breath is done, starting over after 5 to 10 full breaths. “How long is he to go on counting? Until, without counting, mindfulness remains settled on the in-breaths and out-breaths as its object. For counting is simply a device for setting mindfulness on the in-breaths and out-breaths as object by cutting off the external dissipation of applied thoughts. (2) Connection is the uninterrupted following of the in-breaths and out-breaths with mindfulness after counting has been given up.

Visu VIII 198: “The navel is the beginning of the wind issuing out, the heart is its middle and the nose-tip is its end. The nose-tip is the beginning of the wind entering in, the heart is its middle and the navel is its end... When he is counting the breaths in the place touched by each, he is giving attention to them by counting and touching. When he has given up counting and is connecting them by means of mindfulness in that same place and fixing consciousness by means of absorption, then he is said to be giving his attention to them by connection, touching and fixing.

Visu VIII 214: “When he does so in this way, the sign soon appears to him. But it is not the same for all; on the contrary, some say that when it appears it does so to certain people producing a light touch like cotton or silk cotton or a draught. But this is the exposition given in the commentaries: It appears to some like a star or a cluster of gems or a cluster of pearls, to others with a rough touch like that of silk-cotton seeds or a peg made of heartwood, to others like a long braid string or a wreath of flowers or a puff of smoke, to others like a stretched-out cobweb or a film of cloud or a lotus flower or a chariot wheel or the moon’s disk or sun’s disk.”

Visu VIII 217: “And here, the consciousness that has in-breath as its object is one, the consciousness that has out-breath as its object is another, and the consciousness that has the sign as its object is another. For the meditation subject reaches neither absorption nor even access in one who has not got these three things.”

Hypotheses on training for jhanas from the Visuddimagga

The Visuddimagga devotes over 300 pages to the study of access concentration and jhana, so the above summary may well be incomplete. For example I have omitted an entire chapter devoted to “supernormal powers” (ability to read minds, ability to fly) ascribed to adepts in absorption. Instead I have isolated those passages that describe any physiological-based methods or psychological-based methods that may be related to current theories in physiology or psychology that give rise to the neurological states of jhana.

H1: A safe environment is necessary prior to sitting. Altered states of consciousness can be deadly if one attempts to meditate near wild animals, traffic, or other potentially perilous environments. The Visuddhimagga acknowledges this by recommending the proper monastery, by avoiding forest locations with biting flies, robbers, etc. It goes further to recommend that one should cultivate those skilled in absorption and should avoid those unskilled.

H2: Intention is set at the beginning of a session. Psychology finds that setting the goal or intention ahead of action improves performance. The Visuddhimagga states that prior to sitting, intentions should be set: “So, after seating himself in the way stated, he should review the dangers in sense desires in the way beginning, ‘Sense desires give little enjoyment’ and arouse longing for the escape from sense desires, for the renunciation that is the means to the surmounting of all suffering. He should next arouse joy of happiness by recollecting the special qualities of the Buddha, the Dhamma, and the Sangha; then awe by thinking ‘Now this is the way of renunciation entered upon by all Buddhas, Paccekabuddhas, and noble disciples’; and then eagerness by thinking ‘In this way I shall surely come to know the taste of the bliss of seclusion. After that he should open his eyes moderately, apprehend the sign, and so proceed to develop it. (*Visu IV 27.*)

H3: “Inner landmarks” should be enumerated and instructions given depending on which of these inner landmarks is observed. Just as a physician must diagnose a patient’s state from signs and symptoms, one would hope that a meditation manual would list these signs and symptoms and give recommended treatments for each. In fact, the Visuddhimagga contains a surprising dearth of “inner landmarks.”

On the positive side, the book gives the “learning sign” and the “counterpart sign” for each of the 40 objects of meditation. These are the crucial landmarks that appear just prior to access concentration, and are described in the quotations above. Unfortunately, the book acknowledges that there is considerable disagreement about the signs, and different people may experience different signs (though they do not attempt to explain why): “When he does so in this way, the sign soon appears to him. But it is not the same for all; on the contrary, some say that when it appears it does so to certain people producing a light touch like cotton or silk cotton or a draught. But this is the exposition given in the commentaries: It appears to some like a star or a cluster of gems or a cluster of pearls, to others with a rough touch like that of silk-cotton seeds or a peg made of heartwood, to others like a long braid string or a wreath of flowers or a puff of smoke, to others like a stretched-out cobweb or a film of cloud or a lotus flower or a chariot wheel or the moon’s disk or sun’s disk.”

Another example of inner landmarks is instruction in breathing: “As he breathes in and breathes out long in-breaths and out-breaths reckoned as an extent, zeal arises.” However, neither zeal nor the later-mentioned gladness are well defined nor contrasted with other feelings that the student may have at this point. A final example of “inner landmarks” comes in discussion of the 10 skills in absorption, where the 4th through 6th give best detail on what to do if the mind is over-slack or over-excited: “(4) exerting the mind on an occasion when it should be exerted [When his mind is slack with over-laxness of energy, etc., then instead of developing the three enlightenment factors

beginning with tranquility, he should develop the remaining factors: investigation-of-states [which states are profitable and skillful and which are not], the energy enlightenment factor, and the happiness enlightenment factor], (5) restraining the mind on an occasion when it should be restrained [When his mind is agitated through over-energeticness, etc. then, instead of developing the last 3 factors, he should develop tranquility [seven things lead to the arising of the tranquility enlightenment factor: using superior food, living in a good climate, maintaining a pleasant posture, keeping to the middle, avoidance of violent persons, cultivation of persons tranquil in body, and resoluteness upon tranquility.] (6) encouraging the mind on an occasion when it should be encouraged [when the mind is listless, then he should stimulate it by reviewing the eight grounds for a sense of urgency (birth, ageing, sickness, death, suffering of the states of loss, suffering in the past rooted in rebirth, suffering in the future rooted in rebirth, and suffering in the present rooted in search for nutriment].”

With these clear exceptions, the Visuddhimagga is surprisingly silent on “inner landmarks” for the meditator. It is silent on what to do if an unskillful image, sentence, or song continues to distract the meditator. It is silent on how to deal with pain or frightening images or doubts in faith. One would expect that these would challenge many meditators on the way to jhana, yet the book is silent on these.

H4: Training should progress to successively more subtle exercises requiring finer perception of stimuli and finer control of muscles. Consistent with modern psychology, the Visuddhimagga prescribes tactile exercises to improve conscious breathing in 8 stages: (1) counting, (2) connection, (3) touching, (4) fixing, (5) observing, (6) turning away, (7) purification, and (8) looking back on these (Visu VIII 197). The first four are practiced prior to the appearance of the sign and absorption, and after the student has become fluent in attaining absorption, he works on attaining insight via the later 4 of observing, turning away from material concerns, purification, and looking back on these to fix them in memory. Further, the first 4 exercises become progressively finer, with the first just counting whole breaths, then touching 3 different places that each breath touches and fixing the perception there.

Another example of progressive training is for the 4 divine abidings of lovingkindness, compassion, joy, and equanimity. Four progressively more difficult subjects are taken, starting with self and progressing to a love one, a neutral person, and finally to a negatively-viewed person. Alone among the 40 objects of meditation, the sign for these 4 is not visual, but a recognition that one can give as much lovingkindness to a negatively-viewed person as to a loved one or oneself.

Having summarized the instances where the Visuddhimagga conforms to H4, I was surprised by how often the book does NOT offer sequenced exercises for successively more subtle stimuli. For example, only one exercise is prescribed for all of the 10 kasinas, so no sequence of progressive training is given there for these ten. Also, no mention is made of subtle stimuli that the meditator can with practice become aware of, such as the heartbeat. No mention is ever made of the heartbeat, or of the subtle “ringing in the ears” that some modern meditation teachers offer. If the goal is to become aware of progressively more subtle stimuli and responses, then progressive exercises in awareness should be offered to improve meditation training.

H5: Rhythmic movement may initiate altered states. Our previous review of altered states concluded that rhythmic movement can initiate altered states (as in Sufi dance or tantric yoga), particularly rhythmic movement of the spine by the deep postural muscles. Contrary to this hypothesis, no such instructions exist in the Visuddimagga. Rhythmic movement is never mentioned in the Visuddimagga as a means of absorption. Spinal movement is not mentioned. In fact, the only mention of backbone is preparatory to meditation: “having placed the upper part of the body erect with the eighteen backbones resting end to end. For when he is seated like this, his skin, flesh, and sinews are not twisted and so the feelings that would arise moment by moment if they were twisted do not arise.” This recommends no movement of the back, but simple resting of one vertebra upon the lower one.

Importance of visual processing in access concentration

A major surprise in reading this ancient text was the importance of visual processing in achieving access concentration. The text contains many more references to visual processing than to auditory or tactile processing. Specifically, all of the first twenty objects of meditation are visual, and most of the “learning signs” and counterpart signs are visual. This emphasis on visual processing is in contrast to most current teachers of Theravada meditation, who simply instruct students to close their eyes then ignore visual processing.

This emphasis on visual processes makes sense from the viewpoint of neurology, because almost one third of the entire brain is devoted to visual processing. Hence any training to increase brain integration and “bring the mind to one-pointedness” must include visual centers. In contrast, current teachers of Theravada meditation are almost silent on visual stimuli, simply instructing meditators to close their eyes. (But Tibetan meditation instructors are more likely to suggest keeping the eyes half-open, looking at a blank wall. They also assign visual mandalas as objects of meditation and place those mandalas in their temples).

This emphasis on visual processing also makes sense if one wishes to maximize bodily relaxation. Each eye contains 8 muscles (6 for positioning the eyeballs up, down, right, left, and circularly, one for close vision, and one for iris control of bright light). Fear causes a sharp orienting response in all these muscles, so they must be consciously relaxed to induce bodily relaxation. In contrast, most current teachers ignore the eyes and simply say they should be closed. But those eye movements will continue even with eyes closed unless we become aware and train them.

What types of visual training does the Visuddimagga recommend?

H7: The 10 kasinas are created to maximize their retinal afterimage. Despite the stereotype of a Buddhist monk meditating on a candle flame, this is NOT recommended in the Visuddimagga. Instead, care must be taken to cut a hole in leather or cloth to look through at a larger “fire”. You can experiment yourself in a dark room and find that the afterimage of a candle flame is not strong because the flame wanders and wavers too much. But a clean-cut hole with a fire behind it will produce a strong retinal afterimage with clean edges. Similar instructions are given for the light kasina. The dimensions of each kasina are also carefully specified, along with the distance they should be placed

from the eyes. From the instructions for creating earth kasina, the circular image covers about 11 degrees of the visual field.

H8: The “learning sign” is physiological and is the retinal afterimage of the kasina. The Visuddimagga specifies visual training to produce the image both when the eyes are open and when eyes are closed. This can be done by becoming aware of the retinal afterimage of the kasina when the eyes are closed. If one closes the eyes and tries to retain the same image, then one must train the positioning muscles of the eye to remain motionless while the eyelids are blinked. Untrained people cannot do this, instead usually moving their eyes upward when the blink occurs to maximize their lubrication with tears. Once the eyeballs remain motionless, the retinal afterimage will be superimposed on the original image with open eyes. The Visuddimagga provides this training by stating: “It should be adverted to now with eyes open, now with eyes shut. And he should go on developing it in this way a hundred times, a thousand times, and even more than that, until the learning sign arises. When, while he is developing it in this way, it comes into focus as he adverts with his eyes shut exactly as it does with his eyes open, then the learning sign is said to have been produced.” (*Visu IV 29*).

The image of the lightbulb below allows experimentation with retinal afterimages. Steadily fixate on the central filaments of the black lightbulb for ten seconds or more, then close your eyes, and you will see the (negative) retinal afterimage of the bulb clearly, now bright white. This is due to “bleaching” of the photopigments of the cones in the retina when the eye is fixated.



Another example of retinal afterimage is “spiritual bodies” from the chakra literature of India. These teachers say with proper training one can “see” another person’s “spiritual body” when the eyes are closed. If one fixes the eyeballs on the eyes of the other person, closing one’s eyes produces a “negative” afterimage where the previously bright face is dark and the previously dark spots appear bright with light. The two darkest spots on the face are the eyes and mouth, so that their negative afterimage shows them glowing with light. This is taken as evidence of spiritual chakras, though current science could cause any spot on the face to glow in afterimage by reducing illumination to it.

H9: The eye muscles can be used to manipulate the retinal image of the ‘counterpart sign’. The most common “counterpart sign” listed by the Visuddhimagga is a beautiful disk that appears to the mind, like a bright moon, but more beautiful than the real moon. The 10 kasinas would presumably give practice in seeing this, since the kasinas themselves are often circular disks, and their retinal afterimages would yield circular disks.

Even after the retinal afterimage fades to black, it is possible to create circular disks similar to ‘counterpart signs’ by particular eye exercises. Specifically, I have experimented with creating yellow and blue “nimitta” by suddenly tightening my focusing

muscles, as if to view a near object. The sudden muscle shift may disturb the retinal cones, causing them to fire NOT due to light stimulation but due to mechanical stimulation. With practice, this “nimita” can be made to appear symmetric and to appear in both eyes equally. Similarly, I have experimented with enlarging a visual nimita by using the 4 sets of positional eye muscles to circle the outer edges of the nimita. This appears to make it larger in size.

The Visuddhimagga did not mention eye muscles, but it suggests that purposeful movement by the eyes can enhance the “counterpart sign”: “Extending the counterpart sign: He should first delimit with his mind successive sizes for the sign, according as acquired, that is to say, one finger, two fingers, three fingers, four fingers, and then extend it by the amount delimited, just as a ploughman delimits with the plough the area to be ploughed and then ploughs within the area delimited.”

Conclusion

I reviewed the instructions for jhana in the Visuddhimagga, posing 9 hypotheses based on current knowledge in physiology and psychology. We found that the Visuddhimagga does follow some current guidelines for optimal training, such as setting clear intentions and goals prior to meditation and offering some progressive exercises to make the meditator aware of successively finer and finer stimuli. Yet it fails to provide many progressive exercises on sensing subtle phenomena that would be natural today, such as exercises on sensing the heart beating, peristalsis in the gut, noticing what thoughts tend to cause anxiety, etc. It is known today that people who can sense their heart beating have a more developed insular cortex (used to sense inner states of the body). Progressing to even more subtle phenomena, biofeedback training could make students more aware of their bodies, by sensing and controlling blood pressure and temperature in bodily extremities. It appears that the Visuddhimagga did not pursue such simple exercises as sensing the heartbeat because they distrusted the body and wanted to leave it behind. This is evidenced by their 10 corpse meditations, aimed at evoking disgust at every bodily part. In contrast, current science sees the body as essential to the arising of consciousness and mind, and current psychology views rejection of any part of the body as a defense mechanism. Hence in the light of current knowledge, progressive exercises in sensing subtle body sensations and thoughts would be expected to improve meditation training.

Another surprising finding is that the Visuddhimagga places much more emphasis on visual processing to achieve jhana than current meditation teachers do. The text contains many more references to visual processing than to auditory or tactile processing. Specifically, all of the first twenty objects of meditation are visual, and most of the “learning signs” and counterpart signs are visual. This emphasis on visual processing is in contrast to most current teachers of Theravada meditation, who simply instruct students to close their eyes and to ignore visual processing. I believe that modern science supports the Visuddhimagga over current practice because the brain devotes more than one third of its neurons to visual processing. Hence it is necessary to work with visual processes to achieve “whole brain integration” that is the hallmark of brain images from advanced meditators. The Visuddhimagga does this through kasinas and visual “signs”, but we would also argue that further exercises should be developed to relax the 8 sets of eye muscles and to observe quietly the visual process. Lastly, I use current psychology to

argue that some of the visual “signs” of the Visuddhimagga may be artifacts due to retinal afterimages, and can be controlled by subtle movements of the 8 sets of eye muscles. Nevertheless I hypothesize that exercises in visual processing would improve any meditation training with the goal of “whole brain integration.”

In closing, I want to caution scientists not to reject the entire Visuddhimagga just because some of the phenomena can be better explained with current physiology and psychology. We know that advanced meditators can do things with their brains that average people cannot, and that they have higher resilience and greater happiness. Reviewing the ancient texts for their explanations will allow experiments to see which explanations are correct, and to design accelerated training in these valuable practices.