Penetrative Sutta  -AN 6.63 excerpt (Thanissaro)

"Intention, I tell you, is kamma. Intending, one does kamma by way of body, speech, & intellect."

Sutta on the Two Kinds of Thought  -MN 19 (Sujato)

Whatever a mendicant frequently thinks about and considers becomes their heart’s inclination. ...

If they often think about and consider malicious thoughts ... their mind inclines to malicious thoughts.

If they often think about and consider cruel thoughts ... their mind inclines to cruel thoughts. ...

Whatever a mendicant frequently thinks about and considers becomes their heart’s inclination. ...

If they often think about and consider thoughts of good will ... their mind inclines to thoughts of good will.

If they often think about and consider thoughts of harmlessness ... their mind inclines to thoughts of harmlessness. ...
"What do you think, Rahula: What is a mirror for?"  "For reflection, sir."
"In the same way, Rahula, bodily actions, verbal actions, & mental actions are to be done with repeated reflection.

"Whenever you want to do a bodily action, you should reflect on it: 'This bodily action I want to do — would it lead to self-affliction, to the affliction of others, or to both? ..."

"While you are doing a bodily action, you should reflect on it: ‘... is it leading to self-affliction, to the affliction of others, or to both? ..."

"Having done a bodily action, you should reflect on it: ‘... did it lead to self-affliction, to the affliction of others, or to both? ..."

"Thus, Rahula, you should train yourself: 'I will purify my bodily actions ... my verbal actions ... my mental actions through repeated reflection.' That's how you should train yourself."
Distinct embodiments of perceiving, evaluating and responding at every level, AND many different types of “memory”

The memory traces usually involve a change in the strength of connections between different neurons
Some Different Types of Memory/Neuroplasticity

(A modern map of the Alaya)
Episodic (Autobiographical) Memory

Memory for specific episodes of experience

For example:
What did you eat for breakfast today?
Where was your favorite vacation in the last 10 years?

Episodic memories are “situated” in an autobiographical context (including specific info about who, where, when, feeling tone, etc).

This differs from semantic memories.
Episodic Memories

- Memories are shaped by internal information.
- Memory serves to *meaningfully guide behavior*, NOT to accurately record the past.
- Changing the *meaning* changes the memory.

Reframing, or changing the perceived context of a remembered event, can change its meaning.
Episodic Memory for a word list

Please listen to this list of 15 words
(without writing them down)

After the list is finished, please write down all you can recall
### Words for the memory test

<table>
<thead>
<tr>
<th>bed</th>
<th>nap</th>
<th>snore</th>
</tr>
</thead>
<tbody>
<tr>
<td>rest</td>
<td>snooze</td>
<td>wake</td>
</tr>
<tr>
<td>awake</td>
<td>blanket</td>
<td>peace</td>
</tr>
<tr>
<td>tired</td>
<td>doze</td>
<td>yawn</td>
</tr>
<tr>
<td>dream</td>
<td>slumber</td>
<td>drowsy</td>
</tr>
</tbody>
</table>

About 50% of people “remember” hearing the word “SLEEP” even though it was NOT on the list.

The word “sleep” is suggested by the “gist” or “meaning” of the word list.

Episodic memory *prioritizes the meaning* of an episode.
Flashbulb Memories

September 11, 2001
Flashbulb Memories

One year later (Sept. 2002), 97% of Americans said they remembered “exactly” where they were and what they were doing the moment they heard about the attacks.

Why this sense of having such a clear memory of the event?

Emotional arousal, meaningfulness, and frequent recollection together lead to a feeling of “very clear memory”
Flashbulb Memories

One year later (Sept. 2002), 97% of Americans said they remembered “exactly” where they were and what they were doing the moment they heard about the attacks.

148 undergrads reported descriptions of their experience both one week and again one year after the attacks.

Descriptions one year later agreed only ~63% with descriptions given 7 days after the attacks.
How do memories over change over time and become **less accurate** than we believe them to be?

The answer lies in how memories are formed and reformed over time.
Three phases of episodic memory

1. Present moment experience
   - Actions, Feelings
   - Perceptions, etc.
   - Episodes of living

2. Memory trace can be updated
   - Labile Store
     - (short term memory)

3. Memory trace resistant to change
   - Stable Store
     - (long term memory)
Three phases of episodic memory

1. “Present moment” experience.

2. A labile store, where they can be updated, modified & consolidated.

3. A stable store, where they can persist relatively unchanged for long periods.

- Retrieving a memory from the stable store makes it labile again!
- Only labile memory traces can be updated.
- ”Updating” = changing it to enhance its useful meaning.
Ongoing “experiences” are represented as patterns of activation in cortical modules.

Retrieving a memory involves *simulating the original pattern of connections* between the cortical modules.
Hippocampal linking of cortical patterns
Is the **first step** in episodic memory

For **fresh (recent)** memories:
The hippocampus stores a “code” that can simulate the links, and regenerate the pattern of activated cortical modules for an experience.

This code is used to retrieve a “fresh” memory.

The code “expires” after 1 – 4 weeks!
Without the hippocampus, “Fresh” memories have only weak links embodied in the cortex itself.
Memory Consolidation takes place over 1 – 4 weeks, as the memory is transferred from a short-term to a long-term form.

Over 1 – 4 weeks, the cortex “learns” to more fully embody the links.
The times when karmic seeds “ripen” are the times they are susceptible to being “destroyed.”

When memory traces are “reactivated” in present experience, they can be reframed and their meaning can change, ... or not.

If it changes, a new stable trace will replace the old one.
Karmic seeds  Memory traces

Ripening

Replanting

Reflection

Exhaustion

 Reactivation, retrieval, *made labile again*

Reconsolidation largely unchanged

Reframing with mindful investigation & compassion

Reconsolidation with fundamentally altered meaning
Implications for Practice & Well-being

- Ripening of difficult “seeds” presents a challenge
- People often replant them with minimal change
- Only with reactivation can these seeds be reflected on, reframed, revised, and exhausted
- Reactivation of difficult seeds is a time of great opportunity!
- Meeting the experience with mindfulness and compassion is key to exhausting the karmic seeds
Implications for Practice & Well-being

- Profound or deeply affecting experiences may benefit from special care when retrieved, especially when they are recent (fresh)

sequence of steps in labile phase

- **“World” sense gates**
- **Present moment experience**
- **Actions, Feelings, Perceptions, etc. (khandhas)**
- **Labile Store (short term memory)**
  - Time window for flexible updating
  - before reconsolidation (especially first 1-2 hrs)
- **Stabilization, Remodeling**
- **Consolidation 2-6 hrs, sleep, 4 wks**
- **Stable Store (long term memory)**
- Memory retrieval
- Memory retrieval

Diagram:

- "World" sense gates
- Actions, Feelings, Perceptions, etc. (khandhas)
- Labile Store (short term memory)
- Stabilization, Remodeling
- Stable Store (long term memory)

Legend:
- Arrows indicate sequence of steps.
- Red arrows represent memory retrieval.
The Five Aggregates (Skandhas)

1. **Rupa** = form. This refers to the body and to materiality in general.

2. **Vedanā** = feeling tone.  
   **Evaluation**  
   This mainly refers to the spectrum of basic feeling tones ranging from pleasant, through neutral, and to unpleasant.

3. **Sanña** = recognition or perception.  
   **Perception**  
   This refers to how we “make sense” of our experiences.

4. **Saṅkhāra** = intention or fabrication or choices.  
   **Intention**  
   This refers to the intentions that give rise to thoughts, speech and actions. Saṅkhāras impel how we react or respond to our experiences.

5. **Viññāṇa** = consciousness or awareness.  
   This enables awareness of direct experience.
The brain is the organ of behavior.

Three main functions are required to effectively govern behavior:

Making sense of what is happening,
Knowing what is important or valuable,
Taking actions to optimize what’s important, given what’s happening.
Midline regions of the brain are specialized for “feeling tone”
Perception & Intention are in distinct cortical layers. Evaluation is in all layers.

Evaluative circuits from lower centers set “priorities” in all six layers.
The Vipallasa sutta (AN 4.49) excerpts:

These four, O Monks, are distortions of perception, distortions of thought, distortions of view...
Sensing no change in the changing, Sensing pleasure in suffering,
Assuming "self" where there's no self, Sensing the un-lovely as lovely —
Gone astray with wrong views, beings Mis-perceive with distorted minds.

...When those with wisdom have heard this [dharma], They recuperate their right mind:

They see change in what is changing, Suffering where there's suffering,
"Non-self" in what is without self, They see the un-lovely as such.

By this acceptance of right view, They overcome all suffering.

- Transl. by Olendski
In: The Nibbana Sutta (AN 4.179)

Ananda asks Sariputta why some people become fully free in the present life. Sariputta replies:

"it’s because some sentient beings truly understand which perceptions make things worse, which keep things steady, which lead to distinction, and which lead to penetration."

(transl. by Ajahn Pasanno in The Island)
The evolved function of perception:
To construct representations of the world that can guide adaptive behavior.

Perception constructs “meaning” from our interactions with the world.
“Meaning” guides our behavior.

Our perceptions are useful but not accurate.
They are distorted in a way that supports survival.
Against a dark background, we see two tiles identical in color and brightness. What happens if we change the context (and thus the meaning)?
The context strongly suggests that the tile on the top *means* a dark tile under bright light, while the one on the side *means* a bright tile in shadow.
Do these two tables have different dimensions, or the same dimensions rotated 90°?
The green line is the left table’s width AND the right table’s length. The two tables have the same dimensions, just rotated 90°.
Changing the **angles** at their **corners** suggests depth & perspective. We “know” greater distance makes things appear smaller, so we expand them in our mind.
Your brain takes the information coming from the eye and creates a perception conforming to what the information has usually meant in the brain's past experience of interacting with the world.
Simple overview of a neuron (brain cell)

Input is received at one end

Output is delivered via the other end

Simplified representation of a neuron for diagrams
Perceptions are built from external AND internal information

*example of vision*

One neuron brings input up from retina

Input is processed in the thalamus

Visual cortex receives signals from thalamus

Using prior knowledge, visual cortex modifies incoming signal to thalamus
Internal information **predominates** construction of meaning

One neuron brings input up from retina

Input is processed in the thalamus

visual cortex receives signals from thalamus

> TEN neurons bring internally generated information from visual cortex to modify visual processing for ONE neuron from thalamus

> 10:1 ratio of modifying neurons to incoming sensory neurons for ALL senses
What we perceive is not "just what is there", but more like "what should be there," based on what we already know.
Donald Hoffman’s “Interface Theory of Perception”
Perceptions -
to be taken seriously but not literally
In mathematical models of evolution by natural selection, Hoffman and others show that perceiving only what affects our “fitness” always outcompetes perceiving the whole truth.
Patient MM
(lost sight at age 3½, surgically restored at age 43)

Right after surgery, he couldn’t make sense of what he saw. Over several weeks and months, he learned to “see” again.
Patient MM
(lost sight at age 3½, surgically restored at age 43)
He had been an expert skier while blind.
After surgery, he initially preferred to ski with eyes closed. With eyes open, he was afraid he would run off course.

Fine et al., 2003
After 2 years, he skied eyes open on all but the most difficult slopes. He now uses his eyes in everyday life, but with limitations.

“The difference between today and over 2 years ago is that I can better guess at what I am seeing. What is the same is that I am still guessing.”

Fine et al., 2003
In adults with recovered vision, this process is slower and less complete.
The internal maps are only partially rebuilt.
An 82 year-old music teacher with a history of progressive macular degeneration, recently reached the point of functional blindness.

He described new onset, nearly constant, vivid, and distressing visual hallucinations, such as a train or a truck barreling through his apartment.

The internal information circuits can construct perceptions even when minimal external information is present. In such cases, they can create problems.
Charles Bonnet Syndrome

Visual hallucinations following visual impairment

Occurs in 10-40% of people after major visual impairment, typically occurs in older persons.
Helped by social dialogue, education, reassurance
"Now suppose that in the last month of the hot season a mirage were shimmering, and a man with good eyesight were to see it, observe it, & appropriately examine it. To him it would appear empty, void, without substance: for what substance would there be in a mirage?

In the same way, a monk sees, observes, & appropriately examines any perception... To him it would appear empty, void, without substance: for what substance would there be in perception?"
“**Form** is like a lump of foam;

**Feeling** is like a bubble;

**Perception** seems like a mirage;

**Choices** like a banana tree;

**Consciousness** like a magic trick...

However you contemplate them, examining them carefully, they are void and hollow when you look at them closely...

- from **Foam Sutta**, SN 22.95 – excerpt transl. by Sujato
In: The Nibbana Sutta (AN 4.179)

Ananda asks Sariputta why some people become fully free in the present life. Sariputta replies:

"it’s because some sentient beings truly understand which perceptions make things worse, which keep things steady, which lead to distinction, and which lead to penetration."

(transl. by Ajahn Pasanno in The Island)
Mindfulness practice can include both narrowly focused and broadly open fields of attention.

Mindfulness involves “the intention to pay attention in a particular way... the ability to recollect what is going on in the present moment”

“we can do this in a... fashion which is much more focused or we can do it in a wider sense”
- John Peacock in Mindfulness, Attention, Awareness (on Dharmaseed)

“Sampajañña is often combined with ... mindfulness (sati–sampajañña), in which case the former term [sati] refers to detailed, micro-awareness while the latter [sampajañña] indicates a broader, more global awareness of an object as it is viewed in its wider context.
- Andy Olendzki, commentary on Anapanasati Sutta, Insight Journal 2009
Overview of early visual system

magenta = left visual field
black = right visual field
Two kinds of nerve cells in the Optic Nerve

Cross-section of the Optic Nerve

Parvocellular Neurons

Magnocellular Neurons
Parvocellular Retinal Neurons

Visual area of the thalamus

Optic nerve

Visual Thalamus

Optic Nerve

Parvocellular Retinal Neurons

Objects

Situations

Magnocellular Retinal Neurons
Parvocellular system in retina
specialized for *small features* & *object construction*

one cone cell two intermediate neurons one optic nerve cell (parvo)
Magnocellular system in retina specialized for *large features* & *situation construction*

~ 50 rods & cones

~ 200 intermediate neurons

one optic nerve cell (magno)
Magnocellular system in retina

Parvocellular system in retina
What is this?

How do I engage here?

Dorsal visual pathway

Primary visual cortex

Ventral visual pathway

What is this?
Two formats are constructed for vision, hearing, touch, & memory

Perception for Action vs. Perception for Cognition

Ventral Stream of Vision
Two formats are constructed for vision, hearing, touch, & memory

Perception for Action vs. Perception for Cognition

Dorsal Stream of Vision
Perception for Action vs. Perception for Cognition

Proximity, speed, configuration,
Well-suited for action planning, intuitive thinking, process memory
(implicit – subconscious)

Many mammals have a similar system

Shape, color, category recognition,
Well-suited for language, abstract thinking, representational memory
(explicit – conscious)

Sophistication unique to humans
(among mammals)
Dorsal Frontal Lobe: Intentions and Action Planning

Temporal Lobe and Ventral Frontal Lobe: Classification & Language

Parietal Lobe

How do I engage here?

Dorsal visual pathway

Primary visual cortex

Occipital Lobe

What is this?

Cerebellum
Dorsal Stream
Supports Actions
Big Picture
Situations
Framed by Intentions/Habits

Ventral Stream
Supports Abstractions/Cognition
Specific Focus
Objects
Framed by Prior Knowledge/Beliefs
What are these objects?
Blue Plastic and Metal Egg beater

Green Plastic Watering Can

The object information is automatically “perceived” in the *ventral* visual stream.
What can you do with these objects?
Hold it by this handle
Spin it using this crank
Whip cream with it!

Fill it up here
Hold it by this handle
Water plants with it!

The handle, the crank, etc. are automatically perceived as “affordances” in the *dorsal* visual stream.
**Dorsal Stream (Action)**

- process-oriented
- often background of awareness
- less easily put into words
- framed by actual intentions
- less easily a conscious focus

**Ventral Stream (Cognition)**

- content-oriented
- often foreground of awareness
- easily put into words
- framed by knowledge
- easily made a conscious focus
Which orange circle is larger?
Now which is larger?

(Ebbinghaus illusion)
Adding context changes “meaning” of the “object”
The “Object” circuits are susceptible to the illusion, but the “Affordance” circuits are not.
The “Object” circuits are susceptible to the illusion, but the “Affordance” circuits are not.

People use the same grasping aperture for both central circles
The dorsal vs. ventral differences are more hard-wired than the left vs. right hemisphere differences.

Similar spectrum of dorsal vs. ventral "streams" for body senses and hearing.

The dorsal vs. ventral differences are **more hard-wired** than the left vs. right hemisphere differences.
Not just simple perceptions - higher-level models of the world also arise along this spectrum.

“Abstraction” models are especially prone to reification.

Often, reified “object” perceptions are a primary source of suffering via unskillful, language-based, ventral stream models.

At the same time, “affordance” perceptions can support skillful engagement with the lived world.
Satipatthana Sutta (MN 10) (Transl. by Bhikkhu Bodhi)
Instructions for establishing mindfulness:

“... a bhikkhu abides contemplating the body as a body, ardent, fully aware, and mindful, having put away covetousness and grief for the world.”

"fully aware" from the Pali “sampajāno”:

adjective form of the noun “sampajañña” ~ very full knowing

Sampajañña - a “non-object-focused” aspect of awareness, may be pointing to the dorsal stream format of perception
Some translations of *sampajañña*

**Nanamoli & B. Bodhi:** sampajañña as “full awareness”

**Thanissaro:** sampajañña as “clear *comprehension*”

**Sujato:** sampajañña as “*situational* awareness”

**Buddhadasa:** sampajañña as “wisdom in *action*”
The commentaries describe four aspects of Sampajañña: 
(adapted from Analayo, in Satipatthana, 2006)

Three of these suggest reliance on dorsal stream specializations

1. Seeing the **intention of any action**; (awareness of intentions)
2. Seeing the **suitability** of any action; (situational awareness)
3. Maintaining sensory restraint in support of mindfulness;
4. Seeing the three characteristics in any phenomenon (inconstancy, unreliability, & not self → big picture awareness).
Sampajañña instructions often emphasize *breadth* of awareness, and attention to our *intentions* (perceptions particularly supported by dorsal stream circuits)

“Sampajañña is often combined with ... mindfulness (*sati–sampajañña*), in which case the former term refers to detailed, micro-awareness while the latter indicates a *broader, more global awareness of an object as it is viewed in its wider context.*

- Andy Olendzki, commentary on Anapanasati Sutta, Insight Journal 2009

”Cultivating clear comprehension, knowing *what we are doing and why*, is a profound and transforming practice. It highlights the understanding that mindfulness is more than simply being present.”

“With clear comprehension ... we *understand the motivations* behind our actions.”

- Joseph Goldstein in *Mindfulness – A Practical Guide to Awakening*