

Motor and Sensory

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Broken Bits Therapy?

- Convergence
- Accommodation
- Eye movement
- Motor
- Sensory
- Reflex
- Strabismus
- Etc.....

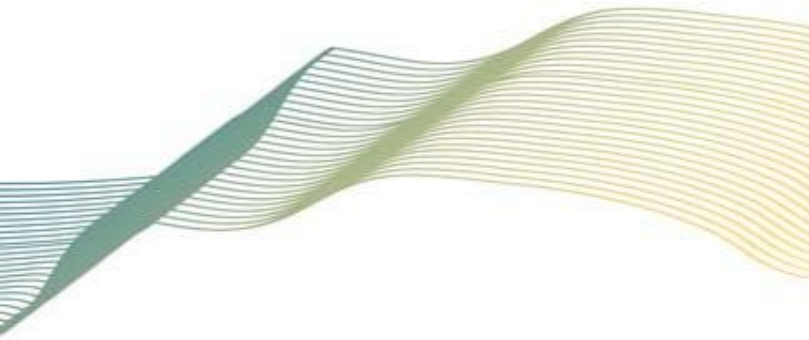


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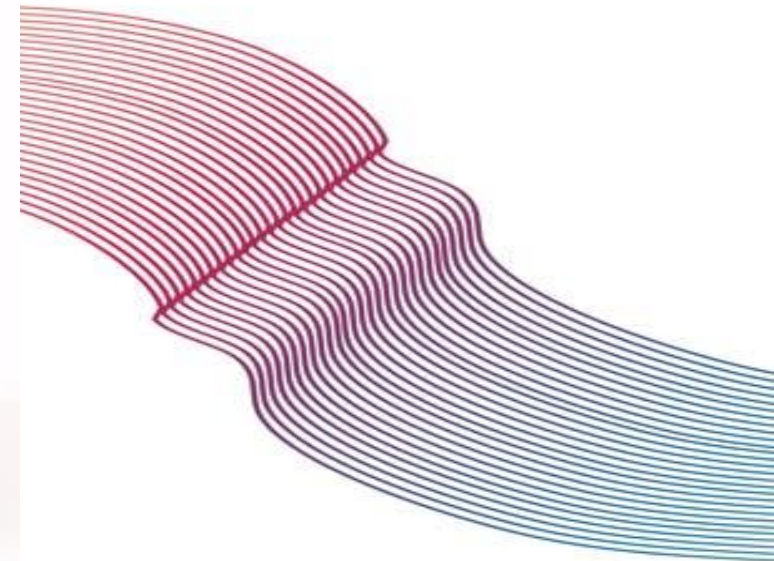
= Aspects of performance

How is the visual process learned?

Development and learning in the first year of life establish the relationship between a movement, and the perception of the sensory input from that movement.



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How is the visual process learned?

Motor and sensory pathways are learned at the same time.



Indivisible and Implicit

Motor and Sensory

- Intrinsic;
- Indivisible;
- Implicit.



Early Experience, the Brain and Consciousness, Dalton and Bergenn

'...movement is an
intrinsic and
ineradicable element
of each and every
sensory perception'.

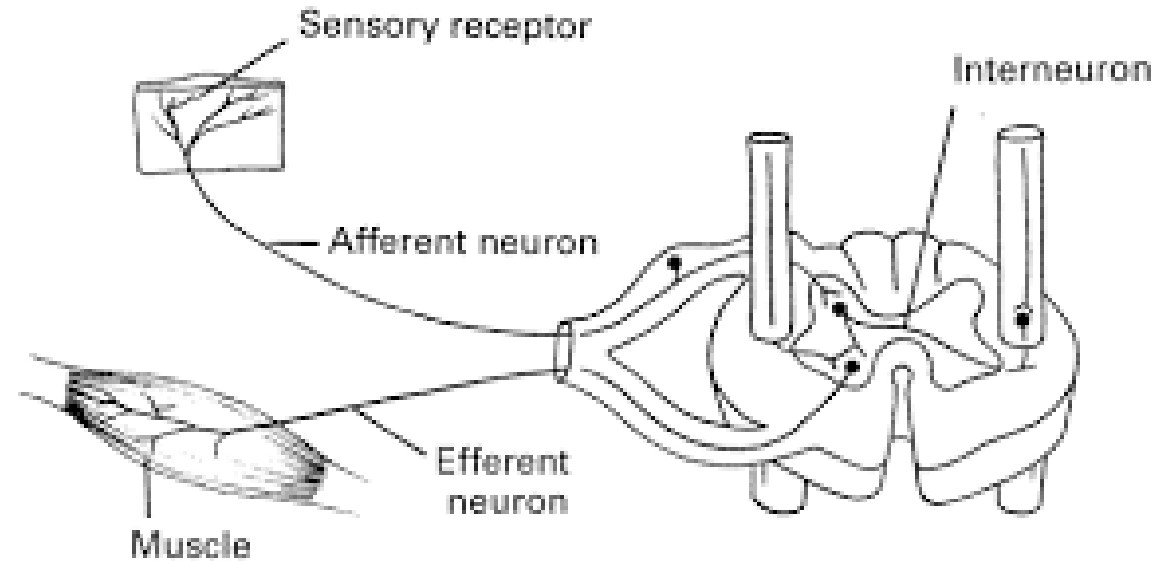


Afferent and Efferent

- Afferent neurons are sensory neurons that carry nerve impulses from sensory stimuli towards the central nervous system and brain, while
- Efferent neurons are motor neurons that carry neural impulses away from the central nervous system and towards muscles to cause movement.

Afferent and Efferent

- Connecting the afferent and efferent neurons is an interneuron (also called associated neuron).



AP Biology

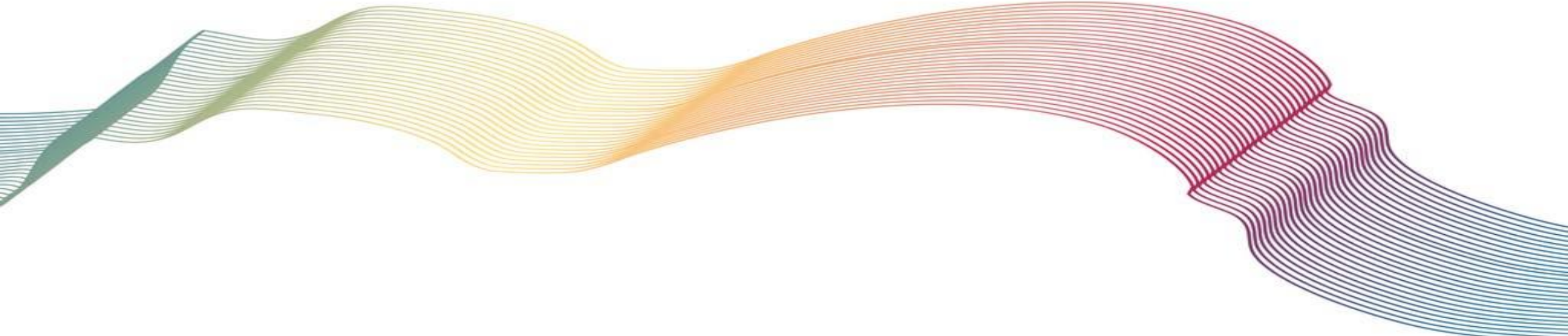
Definitions of Motor and Sensory

Motor

- Posture and movement;
- Efferent pathways.

Sensory

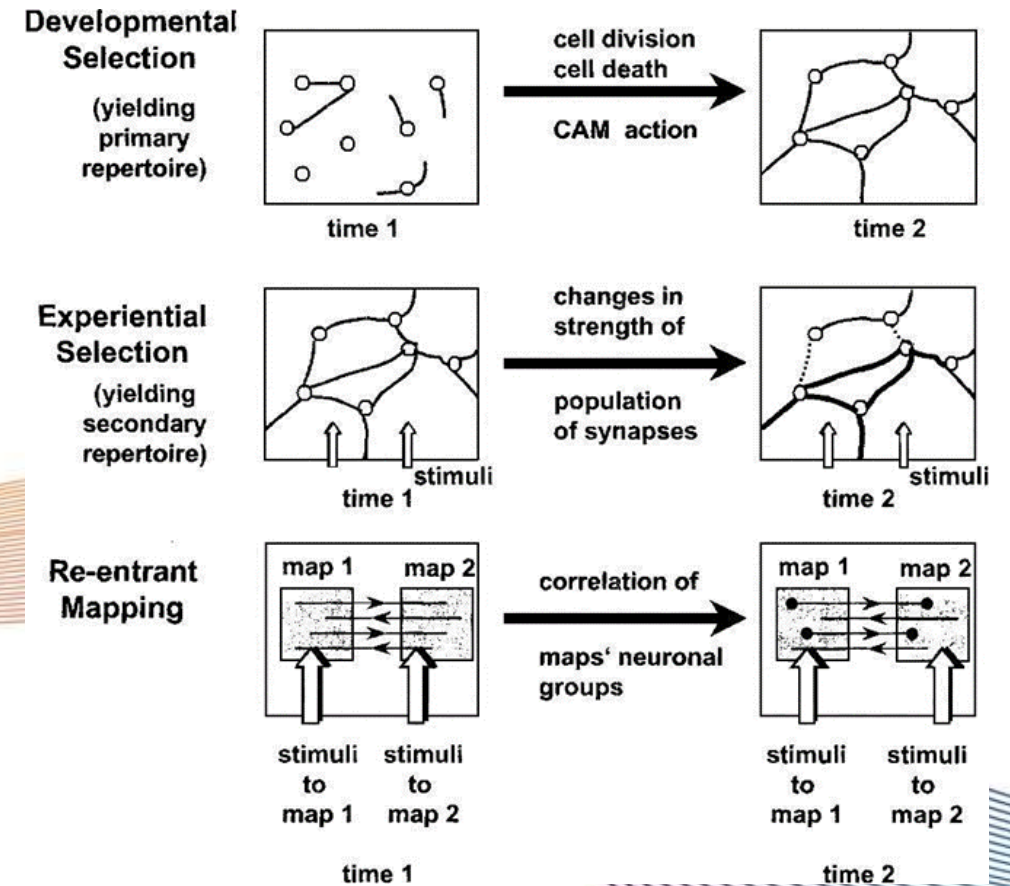
- Sensory stimuli;
- Afferent pathways giving sensory processing;
- Perception.



Edelman NGST

Experiential Secondary Repertoire

Selection on the basis of the afferent sensory information produced by a behaviour, movement or experience.



Perception : internal simulation of action

Perception is more than just the interpretation of sensory messages, perception is constrained by action; it is an internal simulation of action.

Edelman G. and Tononi G. A Universe of Consciousness



Motor and Perception

It is difficult to see how perception can take place in the absence of motor control because sensation involves energetic motions that must be bound together in maps that furnish precepts.

Early Experience, the Brain and Consciousness, Dalton and Bergenn (2007).



Global maps

- Babies are highly dependent on touch (through fingers, feet, and mouths) as well as vision to gain experience of how size, form, shape, and texture co-vary as they move toward and away from objects within their grasp.
- These recurring episodes involve the construction of global maps that consist of small but distinct differences in the number, interaction among, and configuration of neuronal groups.

A. David. Milner & Melvyn A. Goodale - The Visual Brain In Action

Neural Maps

- To understand space, it is important to realise that spatialization is a fundamental property of life.
- The brain uses space to encode sensory inputs.

Berthoz A. Simplicity



Global Mapping

- The cerebral cortex alone is not sufficient to bear the burden of perceptual categorisation and control of movements. The burden is carried out by global mapping.
- A global mapping relates an animal's movement and changing sensory input to the action of the cerebellum, basal ganglia and hippocampus as they connect to the cerebral cortex.

Edelman G. and Tononi G. A Universe of Consciousness

Global Mapping

- The activity of a global mapping reflects the fact that perception generally depends on, and leads to, action.
- When the head is moving to follow a target the motor and sensory portions of a global mapping continually readjust.

Edelman G. and Tononi G. A Universe of Consciousness

Global Mapping

The results of continual motor activity are considered to be an essential part of perceptual categorisation. The dynamic structure of a global mapping is maintained, refreshed and altered by continual motor activity and rehearsal.

Edelman G. and Tononi G. A Universe of Consciousness

Global Mapping

While all visually guided actions take place in space, the spatial coding required will vary according to the action performed. There is no single representation of space in the brain, but instead multiple effector-specific coordinate systems.

A. David. Milner & Melvyn A. Goodale - The Visual Brain In Action

Global Mapping

- Most sensory systems have both exteroceptive and proprioceptive functions.
- Vision, not only provides information about objects and events in the external world, but also plays an essential role in monitoring changes in the visual array brought about by one's actions in the world.

A. David. Milner & Melvyn A. Goodale - The Visual Brain In Action

Definitions of Motor and Sensory

Motor

- Posture and movement;
- Efferent pathways;
- Perception – motor simulation;
- Spatial understanding and timing.

Sensory

- Sensory stimuli;
- Afferent pathways giving sensory processing;
- Perception,
- Spatial understanding and timing.

Vision

Vision

Taking meaning from all sensory input, relating it to previous experience.

The primary purpose of the visual process is to direct action.



Directing action - understanding space

- Understanding of space and position;
- Movement of body, eyes, mind;
- Paying attention to a point within a volume of space;
- Ability to process information within a volume of space.



Peter Jansen, Netherlands

Understanding space

...motor disturbances are associated with large scale deficiency of knowledge gained by visual means.

Merleau-Ponty Phenomenology of Perception



Vision

- Posture and movement;
 - Efferent pathways;
 - Perception – motor simulation;
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- Sensory stimuli
 - Afferent pathways giving sensory processing;
 - Perception,
 - Spatial understanding and timing.

What does that mean for our OVT?

- We are affecting all the processing pathways at the same time.
- It also highlights the importance of movement and posture, and
- the understanding of space, particularly the volume of space that can be processed at any one time by that patient.



Importance of posture

- The development of vision is influenced at every turn by current and antecedent motor factors.
- Whether the eyes are immobilised for visual fixation, or whether they move in pursuit or in exploratory regard, the postural set of the organism is of primary importance.

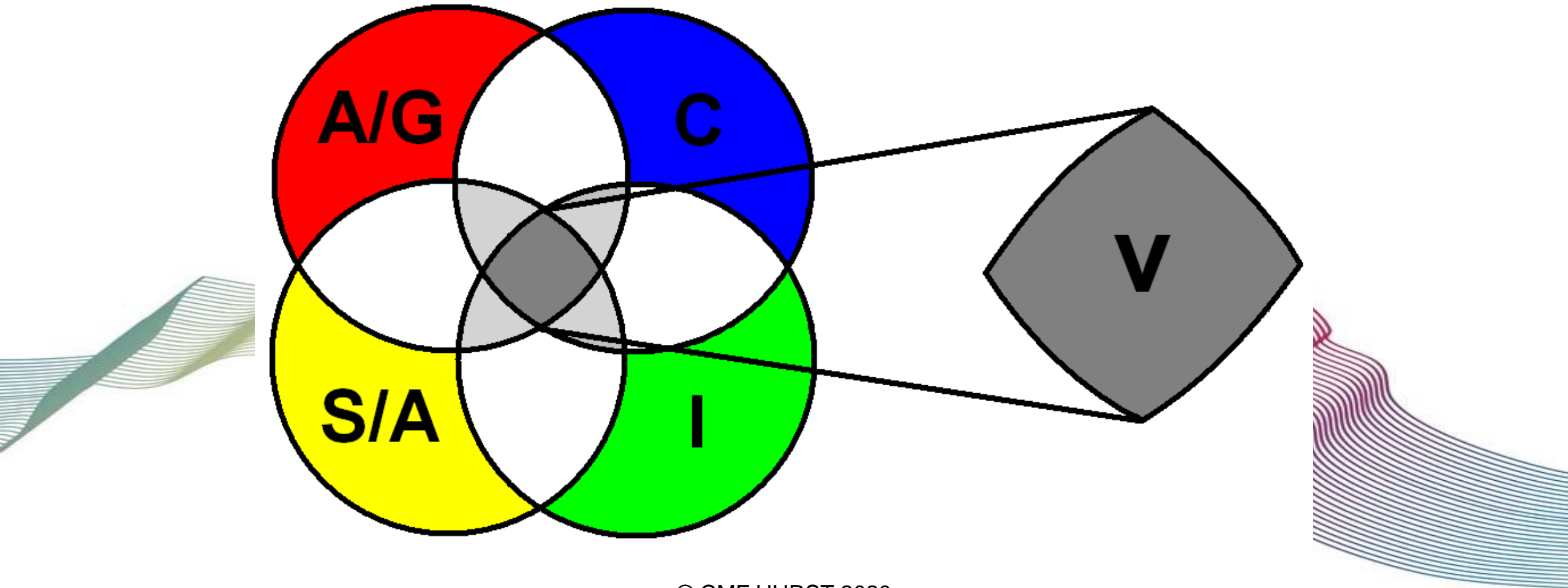
Arnold Gesell et al. - Vision: Its Development in Infant and Child

OVT principles

- Value in itself.
- Prepare for future procedures.
- Practitioner and patient feedback.
- Sustain visual attention AND contain a visual decision.
- Positive stress.
- Relate to visual skills needed in the real world. Visual abilities should be rapid, sustained and at an automatic level.

Birnbaum (1993)

The Visual Process



Add in.....

Also, consider all activities....

- will be affecting motor and sensory processing pathways – they are intrinsic, indivisible and implicit.
- Need to develop the understanding of space, and particularly the volume of space within which the patient can perform.



OVT aims

- It has long been observed that the conscious performance of a motor act often involves the entire body, while with habit, only the necessary muscles are involved.
- It is not only the motor involvement that shrinks with practice. The number and range of sensory inputs that are initially “consulted” for conscious control and that can influence the performance are enormous, including many details and irrelevant stimuli.
- With practice, however, the inputs that affect the performance appear to be restricted just to the necessary ones.

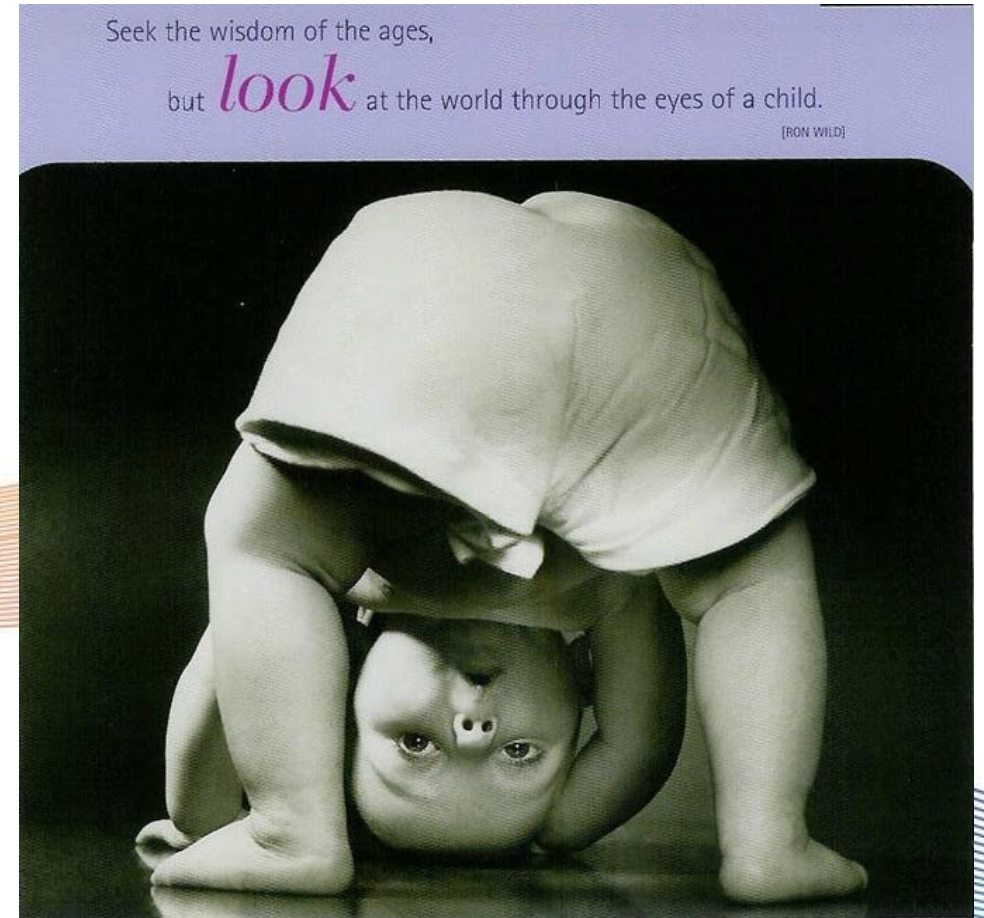
Examples of OVT

- Thumb rotations;
- Brock string;
- Vectograms.



Bottom up? Top down?

- Bottom up?
- Top down?



Bottom up? Top down?

- Bottom up?
- Top down?
- Or all at the same time!!

