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Development
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Development

- We're going to look at the development of the visual process, including the CNS and movement - the development of vision and the whole person.
- Vision is pervasive through the body.
- The basis of visual development is the ability to successfully direct movement; and the outcome of movement is the basis for successful visual development.

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Development

To move with intention, it is necessary that we see space.

To see space, we must experience the volume of space through movement.

The process of development is informed through meaningful experience—movement.

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Neuronal Group Selection Theory
Edelman and Tononi 2000

- Cortical and subcortical systems organised into variable networks, variation is the key.
- The structure and function of each network is selected by development and behaviour.
- The units for selection are collections of hundreds to thousands of strongly connected neurones called neuronal groups.
- The brain selects which groups will be kept or discarded.

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Neuronal Group Selection Theory
Edelman and Tononi 2000

- The NGST bases selection on Darwinian principles of population and natural selection.
- Not only does natural selection apply within species, but applies as somatic selection within a single body to give the variation and selection of individual cell systems.
- So, the selection of a group to be kept depends on the survival of the fittest.

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Neuronal Group Selection Theory
Edelman and Tononi 2000

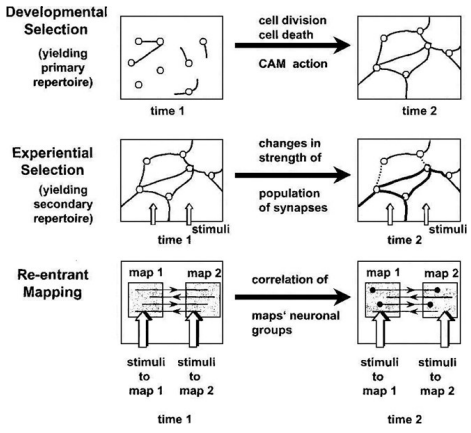
Natural selection from genetics

+

Somatic selection from experience

+

Re-entrant pathways



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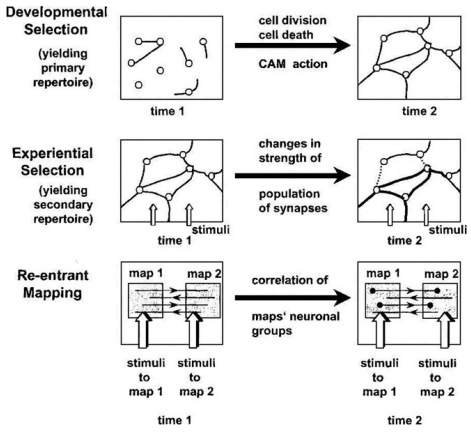
Neuronal Group Selection Theory
Edelman and Tononi 2000

Developmental Selection

Initial anatomy determined by genes and inheritance, neurones extend with extensive variability, diverse primary repertoire of connections.



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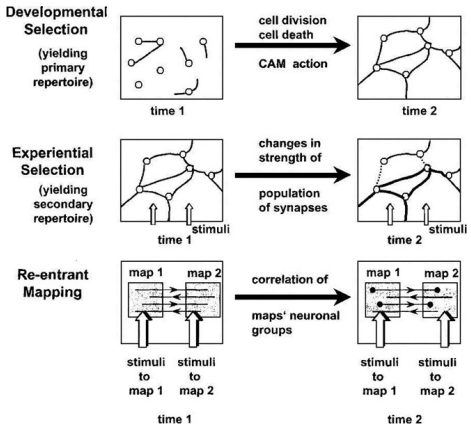
Neuronal Group Selection Theory
Edelman and Tononi 2000

Developmental Selection

- Neurones strengthen and weaken their connections according to individual patterns of electrical activity.
- Neurones that fire together wire together, forming closely connected groups.
- Slight reduction in variability after selections have been made.



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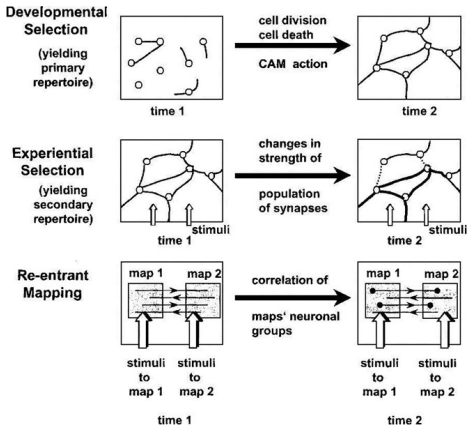
Neuronal Group Selection Theory
Edelman and Tononi 2000

Experiential Selection

- Secondary repertoires develop through experiential selection.
- Overlaps developmental selection and continues throughout life.
- Synapse connection selections within the repertoires of neurological groups that are determined by behavioural experience.



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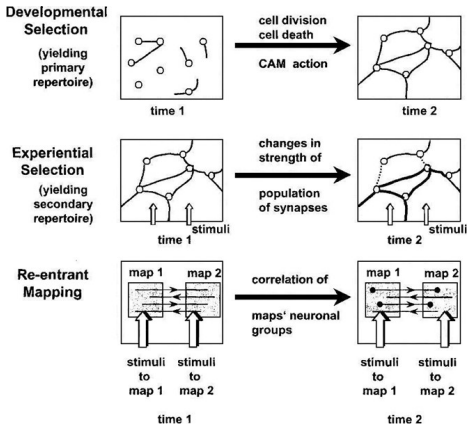
Neuronal Group Selection Theory
Edelman and Tononi 2000

Experiential Selection

- Selection on the basis of the afferent sensory information produced by a behaviour, movement or experience.
- Experiential selection allows for situation-specific neuronal groups, and allows for development of volitional variable behaviour which can be adapted to environmental situations.



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Neuronal Group Selection Theory
Edelman and Tononi 2000

Re-entrant Pathways

- Neuronal groups across the cortex and thalamus are arranged as maps.
- There are reciprocal re-entrant pathways that link across the brain from one area to another.
- There are reciprocal pathways that link maps that are alike; maps with associated function; maps that are in the local area.
- Allows different parts of the brain to respond to the same stimulus. As the re-entrant pathways form a dense meshwork any disturbance in one area of the meshwork can be felt rapidly elsewhere.

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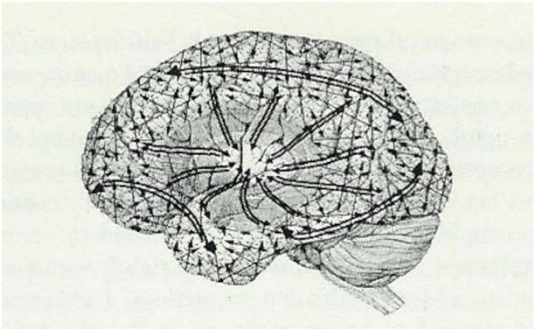
Neuronal Group Selection Theory
Edelman and Tononi 2000

Re-entrant Pathways

- So, Developmental and Experiential selections provide the bases for great variability and differentiation of groups.
- Re-entry allows the integration of information between and within the primary and secondary repertoires.



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Reflexes in terms of the NGST

Primitive reflexes	Developmental primary repertoire	Learning of movements
Postural reflexes		
Developed, automated reflexes	Experiential secondary repertoire	

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Continuity of Neural Functions from Prenatal to Postnatal Life, Various Authors, edited by Heinz F.R. Prechtel, 1984.

- It appears that the term 'reflex' can be used to denote any functional display by the very young nervous system. It has no other meaning than implying reactivity to the stimulation is the basic property of the nervous system.
- The infant's brain has two main properties: it generates motor patterns, both rhythmical and phasic, and it can respond to stimulation. The interaction between these two properties leads to the complex and very individualised and variable display of the infant's behaviour.

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Developmental repertoire – Primitive reflexes

- What are the benefits to the person of having Primitive reflexes in the CNS?
- Once the baby has been born then he will be developing the postural control to make movements as visually directed actions.
- In utero the baby has low tone to help with birth, so will need to build core strength once he has been born.
- The actions of the primitive reflexes are to get us started.

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Development repertoire – Primitive reflexes

- In utero the baby is already making voluntary movements.
- Once born these 'general movements' appear sporadic, and can be called 'fidgety', as the baby does not yet have the development of core strength to make movements seem more meaningful.
- With increasing core strength, and learning, these voluntary movements appear more defined.

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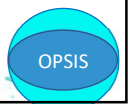
Development repertoire – Primitive reflexes

- The stimulus for a primitive reflex response is often movement of the head, it could be to look at a light or an object of interest.
- From the reflexive movement there is a postural change in the limbs moving the baby to a new posture. This allows the baby to learn to make the volitional movements needed to bring the baby back to their normal posture.
- As the baby learns, eventually these voluntary movements can be made without the need for the initial reflex response.



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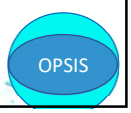
Development repertoire – Primitive reflexes

Primitive reflexes are part of the CNS and are meant to be retained, not inhibited.

The voluntary movement learning after the primitive reflex response is needed all through life -

- in the maintenance of posture and muscle tone;
- to restart movement pattern learning if it has been lost;
- as the basis of fight and flight.



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Continuity of Neural Functions from Prenatal to Postnatal Life, Various Authors, edited by Heinz F.R. Prechtel, 1984

- In a conception of the developing brain which emphasises the involvement of the whole system in all changes during development, and which considers the healthy infant's brain as an age -specific and age-adequate organ system it is no longer valid to use the term primitive reflexes.
- The capacity actively to generate rhythmical as well as phasic motor patterns, and the capacity of reactive behaviour are both required in order to explain the infant's brain.

Instead of 'primitive reflexes', what would be a suitable name to convey these important qualities and actions?

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Benefit to the Person

- What would be the benefit to the person of developing reflexes within the primary developmental selection of the CNS?
- Develop core strength, posture, ability to use both sides of the body and use each limb separately. To learn to rotate the body along it's axis. Move from being startled constantly and gaining maturity.
- What would be the benefit to the person of developing reflexes within the secondary experiential selection of the CNS?
- Develop pathways where several actions can take place from one stimulus. Experiential learning gains greater efficiency and accuracy.

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The Organism Kurt Goldstein 1934

Goldstein's work was looking at the secondary repertoire of Experiential Selections in the Neuronal Group Selection Theory.

- In the experiential selection, reflexes are developed that give a sequence of several movements from one stimulus. E.g. make my leg bend at the knee.
- These reflexes have been learned and developed from experiences, and are a short cut to an action happening. They could be considered as a network.
- The organism develops a multitude of experiential reflexes to gain accurate, efficient movement patterns to one stimulus.

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The Organism Kurt Goldstein 1934

- 'Any reflex reaction relates to the whole organism. Changes that are noted in various responses of the organism are not independent of one another. They constitute a functional unit. Stimulus utilisation depends on the whole organism.
- In the case in which two reflexes are elicited the predominance of one cannot be accounted for by it's greater functional significance for the organism as a whole in a given circumstance'.

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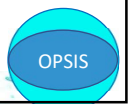
The Organism Kurt Goldstein 1934

- 'The organism is aiming for a dynamic equilibrium and will use the reflex reactions appropriately to move towards that state.
- What if two reflexes are simultaneously stimulated but only one is realised?
- One cannot determine which of the two events is the inhibited and which the inhibiting one.
- Both reflexes could be the inhibitor or the inhibited depending on the situation, the state of the body and the required movement.'

In this way both primitive and experiential reflexes do not need to be inhibited as the organism has it's own mechanisms for regulation.



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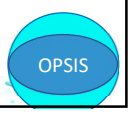
The Organism Kurt Goldstein 1934

Goldstein considers the response to a given stimulus as giving two different responses,

1. Constant reaction, and
2. Reactions of differing strengths which may change qualitatively even to the extent of the appearance of the opposite reaction.

- Such factors can be the state of tension of the muscles and position of limbs. Also, the enforcement or diminution through other reflexes.
- The 'strength' of a limb, at any one time, depends not only on the respective posture and structure but also the condition of the rest of the organism.'



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The Organism Kurt Goldstein 1934

'The direction in the activity of the organism is affected by from the outside

1. Through a specific environment in which the organism lives,

and from the inside,

2. a certain determination and force issuing from the organism itself.'

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Comparison of Reflexes in Primary and Secondary Repertoires of connections

Primary Reflexes	Acquired Reflexes
Develop core strength, posture, ability to use both sides of the body and use each limb separately. To learn to rotate the body along it's axis. Move from being startled constantly and gaining maturity.	Develop pathways where several actions can take place from one stimulus. Experiential learning gains greater efficiency and accuracy.

Whole organism
Inhibition and self regulation
Affected by the state of the organism, position of the limbs etc.

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VT Progression

- With VT we aim to develop a visual process that has the accuracy, efficiency and stamina to achieve the person's potential. We should not limit that potential.
- We can access reflex development in both the primary and secondary repertoires of connections to ensure a robust, steady movement base from which to direct action.

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Gestalt Psychology
G W Hartmann, A T Poffenberger (1935)

- The ground is generally localised behind the figure, is less structured or differentiated, less penetrating, less independent, less meaningful, and in a sense, less "real" and lively than the figure.
- The figure has "thing"-character and the ground "stuff"-character, a thing being considered as stuff plus form, as in the case of a water drop which is essentially water and a representative spherical contour.

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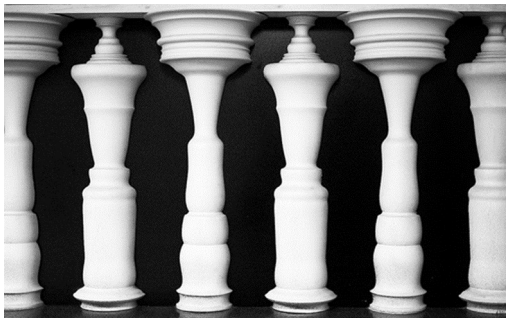
Routledge Philosophy Guidebook to Merleau-Ponty and Phenomenology of Perception (2011)

Gestalt psychologists claim that every visual experience, and perception, will have a figure-background structure, and if an experience is structured in this way, then it is differentiated.



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Routledge Philosophy Guidebook to Merleau-Ponty and Phenomenology of Perception (2011)

- The figure is the focus of attention and is perceived distinctly and in detail, whilst the background is perceived with varying degrees of indistinctness and indeterminacy.
- The subject is conscious of both the figure and the background - they both contribute to 'what it is like' for them - even though their awareness of them is different.

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Visual Psychology S Renshaw (1965)

- The results of movements, and their after-effects, we know form the essential grounds from which emerge meaningful figure processes.
- The ground from which it emerges is the repertoire of body movements by which the figure is made.

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Greg Kitchener 2017

- Form may be a figure but it is not a static object.
- To alter the figure we need to make a change in the ground first.

Caroline Hurst 2018

- Posture forms the ground for movement to emerge as the figure.

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The Organism Kurt Goldstein 1934

- 'Each movement of one part of the body is accompanied by a definite change in the posture of the rest of the body.
- When, in response to a stimulus, one definite part of the field of perception becomes prominent the entire perceptual field changes simultaneously in support of the perception proper.'

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The Organism Kurt Goldstein 1934

- 'In the CNS the changes in response to a stimulus do not take place and to an equal degree. They appear earlier, and with greater intensity near the point at which the stimulus is applied – the near affect. The rest of the system – the distant part is also in very definite state of excitation.
- A reaction at one point is more accurate the more it stands in the foreground as compared with the background. I am inclined to regard this configuration of excitation, the foreground – background relation as the basic form of the functioning of the nervous system.'

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The Question

- So, we see that the figure/ground process in both perception and in the response to a stimulus of the whole CNS.
- How would this understanding of the figure/ground process aid our Vision Therapy?

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