The shift from spontaneous and curiosity driven to goal directed movement

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Infants are very sensitive to the achievement of a successful outcome of an intentional action, especially one that has provided a challenge. Success leads to a spurt of dopamine which enhances learning and motivation to try again.

Early intervention is successful when it helps caregivers to shape the environment to suit the needs and abilities of the infant - and in this way motivate the infant to move, explore, interact and learn more.

Four important ideas about infant learning

1 Infant motor learning can be characterized **as the process by which the infant learns about:**

- the structure of the task (the sequence and timing of movements needed to complete the task),
- the information needed to plan and complete a task,
- how to adapt posture to anticipate and respond to changing forces actin on the body;

2 Infants learning occurs when they interact with the environment through repeated cycles of perception and action.

3 Repetition allows for repeated action-perception cycles, with embedded exploration of different options that lead to success. Read more about perception-action cycles.

4 Infants learn best when they actively engage in self-initiated actions that are somewhat challenging but allow for success most of the time.

5 Repeated experience of success builds the infant's belief in their ability to succeed (self-efficacy).

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Infant spontaneous movement provides the earliest experience

Active movement in the uterus provides the infant with repeated experience of moving the head trunk and limbs in a variety of ways. These spontaneous movements are the first opportunity to link motor commands with proprioceptive feedback from the movement itself as well as the outcome of the movement, such as contact with the uterine wall and contact of the hands with the face and sucking of the hand.

After birth healthy term infants quickly learn to adapt their spontaneous movements to accommodate the force of gravity acting on the body. They also learn to stabilize their heads and trunk when moving the limbs.

During periods when the infant is awake and alert, they start to adapt the spontaneous movements to allow their hands and feet to explore the surfaces they encounter, as well as respond to external events (sounds and sights) in the environment.

The repeated cycles of perception and action are variable, with each repetition providing differences in the movement that is produced and the consequent feedback.

Repeated kicking actions provide a good example of the variability inherent in infant movement. Consider a sequence of kicking movements starting from full extension of the hip and knee of one lower extremity.

The first flexion-extension sequence of movement of the hips and knees will end in an extended position of the hip and knee that is different from start position of the first kicking action. In addition the kicking action will have perturbed the trunk creating a different set of forces acting on the lower extremities which need to be accommodated in the next kicking cycle.

Infants learns to exploit this variability as they become increasingly aware of their ability to engage with and influence, the social and physical environment, and influence their own actions to create interesting and novel experiences.

- *Infants change the pattern of kicking when a bell is attached to one lower extremity.*
- *They learn to quieten their limb movements when visually attending to an interesting event*

Emergence of intentional, curiosity driven exploration

Over the first weeks infants start to intentionally adapt their movements as they increasingly use their hands and feet to explore the surfaces they encounter. When the hands encounter a surface, infants use individual finger movements to explore the texture, size, and "move-ability" of the surfaces they encounter.

They start to reach for objects within easy reach and learn to grasp and steady the object with one hand while using the other hand to manipulate and explore its features.

T**his early exploratory behavior is primarily curiosity driven,** the purpose being to obtain new and interesting information.

"The fact that animals, and particularly humans, seem avidly to seek out information without an apparent ulterior motive suggests that the brain generates intrinsic rewards that assign value to information, and raises complex questions regarding the benefits and computations of such rewards." Gottlieb 2013

The shift to intentional and goal directed actions

From about 4-6 months infant actions are increasingly goal directed.

The infant or child starts starts off by having an idea of what you want to achieve, a goal and possibly some idea of how that goal might be achieved. The next step is to explore ways of achieving the goal – trying out different possibilities and deciding which is the most efficient and then repeating the actions until you can do the action easily.

This process of exploring, trying out possibilities, refining coordination, checking progress is supported by a number of important behaviors including:

- Willingness to approach a new and unfamiliar task
- The desire to achieve your goals – to get things right – called mastery motivation
- Ability to pay attention to the important details of the task – and not be distracted by irrelevant detail
- A sense of your own ability to solve the problem – a belief in your abilities – called self-efficacy
- Ability to put up with the frustration of failure – and the patience to try again