Voluntary Movement of Infancy
Prehension
Motor Development Perspective

• Very important skill that enables the infant to interact with their environment because it involves manipulation of objects

• Baby’s initial attempt to reach, grasp, and manipulate a object is an extremely important sign of motor development

• First sign of voluntary reach and grasp is around 4 months of age

• The reach and grasp seems to appears simultaneously
The development of prehension

• Phase I Reaching & Grasping
  – One-handed reaching
  – The child reach when they see an object.
  – Once the child makes manual contact with the object, vision facilitates hand closure (grasp)
    • Child decides when to grasp based on what they visually perceive.
Prehension
The development of prehension

• Phase II Reaching and Grasping
  – The child attempts **different types of grasps** (differentiation)
  – Infant uses two hands to acquire an external object
  – They can use vision to **correct their reach**
  – The role of vision in grasp to close the hand diminishes and becomes tactile stimulated.
Different Types of Grasps

Halverson (1931) classic study of prehension found that there were three basic and progressive methods of reaching.

1. Sweeping the hand and arm in a backhand manner toward the object
2. Scooping the hand and arm from different angles.
3. Direct reach
Prehension

Clifton et al. (1993) videotaping infants reach for a rattle or glowing object in light and dark environments. The reach and grasp in these infants were enhanced if they could view their own hands.
Reach & Grasp

Development from Phase I to Phase II reach and grasp

- 4 months prehension is controlled by the shoulders and arms; incapable of making contact with the object
- 5 months prehension is controlled by wrist, hand, and finger control; plus thumb in opposition to the fingers; crude contact with object
- 6 months a primitive squeeze grasp emerges (fingers close around the object.
- 9 months prehension can be controlled by thumb and one finger (pincerlike control); fingertips of the 3 fingers oppose the action of the thumb in the grasp
- 13 months fore fingers grasp
- 18 months the child can finally release the object
According the Halverson, prehension occurs in predictable evolving stages with increasing age.

<table>
<thead>
<tr>
<th>Type of Grasp</th>
<th>Weeks of Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Contact</td>
<td>16</td>
</tr>
<tr>
<td>Contact Only</td>
<td>20</td>
</tr>
<tr>
<td>Primitive Squeeze</td>
<td>20</td>
</tr>
<tr>
<td>Squeeze Grasp</td>
<td>24</td>
</tr>
<tr>
<td>Hand Grasp</td>
<td>28</td>
</tr>
<tr>
<td>Palm Grasp</td>
<td>28</td>
</tr>
<tr>
<td>Superior-Palm Grasp</td>
<td>32</td>
</tr>
<tr>
<td>Inferior-Forefinger Grasp</td>
<td>36</td>
</tr>
<tr>
<td>Forefinger Grasp</td>
<td>52</td>
</tr>
<tr>
<td>Superior-Forefinger Grasp</td>
<td>52</td>
</tr>
</tbody>
</table>
Prehension

Recent research by Newell et al. (1989) indicated that one to two hand grasping and differentiation *(picking up an object with two hands)* of the object size is related to the child’s object-to-hand-size ratio.

If the object were scaled to the subject hand size, the grasp is similar to an adult pattern as early as the age of 6-7 years old.
Life time development

Development of the prehension is proxmodistal

At 1 year of age, grasping and reaching development is related to walking, that is, two-hand grasping becomes more pronounced on all reaching tasks at the time the child begins to walk.

Prehension continues to develop throughout the first decade of life.
- Trajectory and magnitude of fingers opening
- We open our hand wider with experience
Refining & Training Prehension

In the beginning repeat the grasp and reach with the same familiar object (shape, size, and weight) this develops the ability to differentiate between objects and improve the one’s anticipation of weight, force, and velocity of prehension.

Then vary sizes, shapes, and weight of the objects and require different reaching and grasping techniques in light and dark environments.

Realize that one’s control of the rate of speed of their grasp and force of the grasp in the beginning of retraining is negatively associated but with practice becomes similar (Pare & Dugas, 1999).

Provide a variety of functional (real life tasks) that involve reaching, grasping, and object manipulation.
Gait

People put too much emphasis on the emergence of upright independent walking.

People assume that if the child walks sooner, he or she is advanced in their motor development. This notion has not been proven.

Let’s examine the stages one take in developing an upright independent walk and various related motor control issues.
Development of the Upright Independent Gait

First we need to remember that we develop cephalocaudally.

We need to first understand the acquisition of voluntary head movements.

- **1 month** of age little or not control
- **2 months** elevates the head when phone with effort
- **3 months** positions head left to right or right to left when prone
- **5 months** elevates head when spine

Control of the head enables infants to scan their surroundings.
Head Control

Little or no control of the head. The head and neck needs to be supported by the child care giver.
Head Control

2 months
Head Control

When the baby can raise the head while lying on his back. The baby will be strong enough to hold up his head while sitting in a car seat or front pack. Wait until he can hold his head up steadily without any support from you to use a jogging stroller or a backpack.

2–3 months
Head Control

By 5 months the child should be able to control their head. At 5 months the child can raise their head when in the supine position (lying on one’s back).
Development of the Upright Independent Gait

Once the child has the ability to elevate their chest and head, the child has gained some control of their arms, hands, and fingers.

Once the chest can be elevated the child will attempt to roll from a supine position to a prone position. This is important because it enables the child to attain a proper position for crawling.
Development of the Upright Independent Gait

Upright independent sitting is an important milestone. It frees the hands so the child can reach, grasp, and release objects.

For early sitting to occur one must support the lower back and abdomen.

By 5 months the lumbar control has stabilized and the child can hold an external object.

By 8 months the child has gained sufficient movement ability to set independently without assistance.
Development of the Upright Independent Gait

6-7 months
Development of the Upright Independent Gait

Self-support sitting is associated with eye-hand coordination (Rohart, 1992).
Upright posture will follow self-support sitting. Following skills will then emerge:

- ability to pull their body from a sitting to standing position
- period of experimental standing with the aid of external objects such as a chair or furniture
- Standing position will be characterized with a high arm carriage and wide base of support.
Development of the Upright Independent Gait
Development of the Upright Independent Gait

Being able to position the body so one can move from one location to another occurs in a predictable progression:

First Crawling
- emerges around 7 to 8 months of age
- involves thrusting the arms forward and then flexing so they drag their body along the surface

Then Creeping
- is elevated crawling with the only the arms and knees.
- contralateral (limbs in opposition) or homolateral (limbs on the same side moving in the direction).
Development of the Upright Independent Gait
Development of Upright Independent Walking

1. **7- 10 months** - Walk with assistance
2. **11 months** – Walk by being led
3. **12 months** – Walking independently

Children who have smaller bones or linear frames walk somewhat earlier than large boned or large framed children.

Keys to developing walking is lateral stability
Heel strike and ground reaction forces pattern of walking similar to that of an adult occurs between 2 -3 years of age.
Stages of Upright Walking

7 months

10 months
Stages of Upright Walking

11 months
Stages of Upright Walking

12 months
Development of the Upright Independent Gait

When the child begins to walk:
- the arms have a high carriage
- very wide base of support
- knees are in the flexed position
- toes pointed out
- length of strides are highly inconsistent.
- lateral stability is poor
Bimanual Control

Bruner examined bimanual control in infants through early childhood.

- By 4 to 5 months children could only manipulate one toy at a time.
- By 6\textsuperscript{th} month the children could reached and grasped two toys.
- By the 9\textsuperscript{th} month, the child can manipulate 3 toys.
- By 18 months, the child is using both hands about 30\% of the time.