A Developmental Systems Framework for Early Intervention

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What is a developmental systems perspective?

"The building of brains, bodies, and flexibility involves a cascading developmental process in which genes and their products interact within their local environment to create the substrates for further development." (Spencer et al 2009)

A developmental systems approach to understanding infant development asserts that development is a process of self-organization, among multiple factors, within the organism and without, driven by interactions and experiences. (Ulrich 2011)

"One hallmark of complex systems—open, thermodynamic systems, such as those in humans—is that they seek higher levels of complexity. This fact fits both the behaviors we observe in early postnatal life, in which infants continually explore and discover new actions, each a bit more demanding than those that led up to them, and our explanation for them. Empirical studies show that even the youngest babies create adaptive, goal-directed movements and demonstrate systematic learning from their experiences, and we know that existing neuromotor strength and control form the scaffolding that supports each subsequent level of construction."

As newborns use their available eye muscle strength and control to attend to objects or people moving through their space, they push their systems, bit by bit, to go farther, to see more and longer. These repeated cycles of moving and perceiving the consequences lead, over time, to sufficient control of head and neck muscles to lift the head and eyes upward, leading to new, interesting things to explore. Their efforts have cascading effects, enabling more and longer movements through greater distances, toward objects, people, and sounds that attract them. Bit by bit, the foundation takes shape and expands for discovering new concepts, consistencies, and motor control. A predesign for this sequence is not necessary, or likely, given individual differences within infants who are healthy, as well as infants with atypical neurophysiological and biomechanical constraints. Yet, probabilistically, the similarities in sequential progressions follow, given the similarities in goals, substrates, and contexts they have to work with." (Ulrich 2010)

Ulrich (2010) lists the following principles that govern change in developmental systems:

- Behavior patterns and changes in patterns emerge via self-organized interactions among many subsystems, intrinsic and extrinsic to the organism, within a context, and the performer's goals.
- Behavior is dynamic and adaptive, changing in response to repeated cycles of perceiving and acting and to variations in the contextual demands or intrinsic capacities of the system.
- There are multiple, redundant pathways to achieving the same functional goal.
- History matters; factors that may not have obvious relevance to a particular outcome may have a profound, cascading impact.
- Organization and change at the level of the nervous system are significantly affected by repeated cycles of perceiving and acting.

A developmental systems framework for early intervention

A developmental systems framework for early intervention takes into account the complex interactional nature of all the factors that influence infant development, behavior and learning.

A developmental systems framework for early intervention has two components:

1 A set of principles to guide the overall structure of the intervention (the what, where, when and how of implementation) based on the best available evidence.

The GAME and Small Step intervention protocols provide such evidence based set of principles for implementing an early intervention program for infants.

2 A set of principles to guide assessment and training based on the best available information about perceptual-motor development and learning, and the interaction between the infant, the task and the environment (T-I-E).

The what, where, when and how of a DS framework for early intervention

Building on the GAME (Morgan et al 2012) and Small Step intervention approaches (Eliasson et al 2016), the Developmental Systems Framework for Early Intervention (DSEIF) is based on a set of principles to guide the implementation of EI for infants at risk for developmental delay, and guide therapists' interaction with, and clinical reasoning for, the individual child and family .

1 Family centred care and the centrality of parents (caregivers)

2 A solution focused and coaching approach to therapy

3 Therapy always starts with the infant's abilities - the cascade nature of development

4 An emphasis on training intensity, repetition and many daily opportunities

5 Experience drives the acquisition of new skills and abilities - and repetition is needed

6 The importance of self-initiated action for motor learning - promoting motivation to move and autonomy

7 The role of exploration, curiosity, and the drive to interact with people and things

8 Promoting enjoyable and meaningful social interaction and communication is central to intervention

9 Promoting use of the hands and feet to explore and interact with and on the environment

10 Attention to feeding, sleep and other aspects of the infant's wellbeing, life and experience

Principles to guide assessment and training: task oriented movement training

Task Oriented Movement Training, in keeping with other task oriented, function focused approaches to early intervention (EI), starts with the assumption that infants and toddlers only learn new skills when they actively engage in exploring their environment and try out different options for achieving their goals.

Advances in our understanding of motor development, control and learning from the latest neuroscience research literature provides a host of new insights into the many factors that contribute to task performance – and how the specifics of motor control are tightly linked to the task and context. In other words, you cannot separate perceptual motor control from the context and task demands. Read more

Factors within the child, the task or the environment can either constrain or promote the infant or child's ability to successfully complete a task.

Task oriented movement training within a developmental systems framework takes as a starting point the idea that behavior is always influenced by the complex interaction between the infant, the demands of developmental task, and the environment.

This means that an infant's ability to perform a particular task is determined by factors within the infant (strength, flexibility, coordination, motivation, interest, level of alertness, attention abilities), the task demands (biomechanical, timing and sequencing of movements, stability and balance requirements) and the social and physical environment.

TOMT to improve tasks that relate to parent identified goals starts by assessment of the infant's present abilities, identifying the factors that constrain/limit task performance and adapting the task or environment to allow the infant to succeed,

General guidelines for assessment

1 Start with the parent identified goals.

- Sit on the floor, reach for, get hold of, and play with a toy without falling over.
- Sit up from lying by herself

2 Identify the developmental tasks that the infant needs master in order to achieve the goal.

- Sit without support and maintain balance when reaching to toys within easy reaching distance.
- Roll from supine to prone, transition to prone kneeling, transition to sitting.
- Roll from supine to side lying, push up on arms to transition to sitting

3 Observe the infant's ability to perform the task.

- Sits without support but balance is precarious and she topples over when she turns head to look to side, or lifts hand to reach for a toy. Bangs her head on play mat she falls backwards.
- When lying supine, the infant happy to stay in position. Not initiating rolling to side lying or prone. Dislikes prone lying, rolls onto her back, does not attempt to push up into prone kneeling.

4 Adapt the task and the environment to allow the infant to successfully perform the adapted task.

This stage is important because it provides a picture of the infant's abilities - and this is the starting point for training.

- Sitting and reaching: Provide hip level support using a 10 cm high step/box on either side, and a 20 cm box at her back to stop falling backwards. Place toys on either side on top of step, and within easy reach.
- Transition from supine to sitting: Practice sitting up from lying on cushion, with chest raised to 45 degrees.

General guidelines for training

1 Start by providing the infant with many opportunities to practice new tasks that are adapted to allow the infant to succeed.

2 Adjust the task and the environment to make the task progressively more difficult and challenging while allowing the infant to succeed most of the time.

3 Share with the parent your thoughts and ideas about how to increase the difficultly of the task.

Encourage the parent to suggest and try out ideas - ways to modify the task, adapt it to suite family routines, or family circumstances.

Explore ways motivate the infant to actively engage with task.

3 Work with parent to create a home practice routine/schedule

With the parent identify opportunities within the day to practice the task.

With the parent consider short time periods for dedicated practice.

Resources

For links to more information and ideas see the web version of this article
A Developmental Systems Framework for Early Intervention
http://tomt.skillsforaction.com/developmental-systems-framework-early-intervention

For a summary of the Small Step program see
http://tomt.skillsforaction.com/info/small-step-program

For a summary of the GAME protocol see
http://tomt.skillsforaction.com/therapy/GAME-approach-EI-cp

References

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