
(pediatric practice, play development, general systems theory)

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This series of two articles presents a model of play development for use in pediatric occupational therapy. Proposing to unify the theoretical approaches of sensory integration and occupational behavior, the model uses play as the unifying link between these two apparently different approaches. This first article reviews the major concepts of sensory integration and occupational behavior, in addition to discussing the differences and similarities between the two. General systems concepts are used as a framework upon which a model of play development is constructed. Three hierarchical levels of play are described—sensorimotor, constructive, and social—with each broken down into several developmental steps.

The purpose of this paper is to present a perspective that unifies two seemingly different approaches to occupational therapy with children: the occupational behavior view of play espoused by Mary Reilly (1), and the sensory integration theory of A. Jean Ayres (2). The conception of these two approaches as a unified whole was developed by the authors while graduate students of occupational therapy. We observed that the differences between the two approaches seemed to lead many in the profession to consider them mutually exclusive frames of reference. In-depth study of basic concepts, however, revealed them to be more complementary than contradictory. This paper represents an effort to synthesize sensory integration and occupational behavior concepts into a model of play development upon which occupational therapy practice with handicapped children can be based.

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We considered play the key link between sensory integration and occupational behavior approaches. Most behavioral scientists would agree that, although the complexity of play renders it difficult to define, a basic characteristic of play is that it is intrinsically motivated behavior that is experienced as pleasurable. A more concise definition is not attempted here. Rather, Reilly's view (1) of play as a multidimensional system for adaptation to the environment is accepted. Her view is consistent with Vandenberg's approach to play as an integral part of the process underlying tool use and social and motor development (3).

A general systems approach was found useful for organizing the complexities of play development in this study. Discussion of play development is limited to the early years of life, but many of the concepts presented could be applied to the understanding of human behavior throughout the life span.

This paper is divided into two sections. Part 1 aims to synthesize theoretical concepts from both occupational behavior and sensory integration approaches. After a review of the two approaches and a discussion of their differences and similarities, a model of play devel-
opment is presented, incorporating concepts from both. In Part 2, the interrelationships between sensory integration and play are explored as they relate to clinical practice. Implications for understanding dysfunction are discussed, and suggestions for assessment and treatment are made, drawing from the literature in both sensory integration and occupational behavior frames of reference.

Review of Sensory Integration and Occupational Behavior Approaches

Sensory Integration. Sensory integrative theory and practice are concerned with the relationship between fundamental sensorimotor capacities and more complex functional areas, such as academic learning (2). Therapists involved in sensory integration practice address a specific client population at a very basic level of human function—that of sensory processing and neural organization—to enhance clients' abilities to effectively function in their daily life environments. Because effective environmental interactions are dependent on an accurate interpretation of a specific environment, sensory integration practice focuses on the individual's abilities to organize and derive precise information from basic sensory inputs arriving from the body and from the external environment. Sensory integrative development is theorized to occur primarily in early play experiences (4); thus therapy strives to create a playful environment within the context of specific activities to enhance sensory integration and adaptive capacities.

Occupational Behavior. The occupational behavior frame of reference is directly concerned with play. Drawing from the profession's historical roots, Reilly wrote that the work-play phenomenon in human life should be considered the foundation for practice and research in occupational therapy. The term occupational behavior referred to the developmental continuum of play and work within an individual's life span (5, 6). In building a knowledge base for this perspective, Reilly and her associates contributed exploratory studies relating play to learning skills, rules, and roles for life tasks (e.g., 1). Play is viewed as the primary activity of the young child, and prerequisite to competence in occupational roles throughout life.

Comparing the Two Approaches. Sensory integration and occupational behavior/play approaches appear to have taken quite different paths in developing theory, research, assessment techniques, and treatment methods. Table 1 summarizes the most prominent differences between the two approaches. The features identified under each approach are intended to represent areas of emphasis rather than complete listings. For example, therapists who use an occupational behavior approach may use standardized evaluations when appropriate, but the literature has stressed history-taking and description of observations as primary methods for assessment. The sensory integration literature, on the other hand, has largely focused on the use of standardized tests, although therapists practicing from this perspective also use history-taking and clinical observations in assessment.

These differences seem to create a polarity between the two approaches. Occupational behavior is very broad in scope, integrating information from diverse fields of inquiry in order to understand human problems. At the opposite pole, sensory integration focuses on one aspect of human development, that which is mediated by central nervous system functioning. In doing so, it gains precision in measuring and describing the particular types of human problems it...
stressed during the child's first year of life. Yet, constructive aspects of play, as well as social aspects, particularly in the form of caregiver-child interactions, certainly exist at this early time. As one level comes to predominate over another, the emphasis of the child's play gradually changes. When each level operates effectively, the result is a child competent in interacting with the environment.

General systems theory (GST) provides a structure upon which to build the model of play development. In choosing a GST approach to integrate theoretical aspects of sensory integration and occupational behavior, the authors followed a path first paved by Reilly (1), Kielhofner, Burke (27, 28), and others. Traditionally, science has tended to view the world as the sum of its parts. In contrast to the rigorously empirical approaches of classical science, GST views phenomena as wholes in their environments, rather than studying carefully isolated parts (29, 30). GST is designed to describe, explain, and eventually predict the interactions of a large number of variables, and as such appears to offer new avenues for understanding human beings and their interactions with and within their environments.

Open systems are characterized by the import-export activities they conduct with their environments. The open system continually takes in something from its environment and gives out something to its environment, all the while maintaining its structure amidst this flow. These system-environment interactions are best understood by using the concepts of input, throughput, output, and feedback. As this model is one of an open system, it is assumed that there are interactions occurring between the system (child)
Figure 2
Expanded hierarchical model of play development

1. Sensory Motor
   - Sensation
     - Feedback
     - CNS organization, including sensory integration
     - Adaptive reflexive response
   - Perception
     - Feedback

2. Constructive
   - Objects
     - Feedback
     - Imagery
     - Problem solving and tool use
   - Learning rules of objects
     - Feedback
     - Combing and sequencing
   - Objects
     - Feedback

3. Social
   - People
     - Feedback
     - Learning rules of people
     - Social participation
   - Cultural norms
     - Feedback
     - Internalization of social roles
     - Sociodramatic role play; Games with rules

4. Feedback
   - Feedback
   - Feedback
and the environment at each level of the model. These interactions are depicted by successive feedback loops. At each level, there are inputs, throughputs, and outputs, part of which are fed back into the system to facilitate growth, development, and hence, a change toward increasing complexity. By definition, input is energy, material, or information arising from the external environment or from internal sensations. Throughput refers to processes within the system that transform input to output. At lower levels, throughput is more of a neurophysiological process, but as the hierarchy is ascended and the complexity increases, throughput becomes more of a cognitive and, eventually, a social process. Output is conceptualized as a force from the system that acts on the environment. Again, energy, information, or material can act as output; this includes behavior in the case of the human system. Feedback is defined as that part of the output that returns to the system as input, serving to modify throughput processes and influence future output toward higher levels of organization (31, 32).

Figure 2 shows an expanded version of the basic model. Within each level of the play hierarchy, the authors have identified two or three feedback loops that highlight the developmental process. Research from occupational therapy and psychology was used in identifying the specific inputs, throughputs, and outputs occurring in each feedback loop. Later discussion of this model will begin at the sensorimotor level with the first feedback loop (bottom of Figure 2) and progress up the hierarchy.

Models ultimately distort the phenomena they attempt to explain. This model is no exception. Three distinct levels of child’s play are depicted, each broken down into several steps; but it must be remembered that the boundaries of the model are artificial ones allowing explanation and discussion of the phenomena. In reality, play development probably occurs in many small, gradual steps, rather than in these large steps. Nor are the levels of play exclusive of one another, as the model might suggest. Rather, it is proposed here that aspects of all levels occur throughout development; the emphasis changes as one level comes to predominate over another. Nevertheless, all types of play may occur simultaneously at each level of the model. For example, the young child spends the early part of life engaged predominantly in sensorimotor play. There certainly may also be constructive and social aspects to play at this level, but the emphasis is on the development of sensorimotor skills. In a gradual process, the emphasis changes to focus on constructive and, later, social aspects of play.

According to GST, most of the more complex systems one encounters in nature are hierarchically organized. Within this hierarchical structure, interrelated subsystems interact dynamically with one another. A categorization of these interactions has been offered by Feibelman (33). Because this model of play development is characterized by its hierarchical organization, Feibelman’s laws of hierarchical levels are pertinent in this case:

1. The complexity increases at higher levels. The child’s social play is considerably more complex than earlier play. In social play, interactions occur with more parts of the environment, throughput processes are increasingly more intricate, and resulting behaviors are certainly more complex.

2. Higher levels depend upon lower levels. The adequate development of sensorimotor play contributes to good constructive play. This, in turn, forms the basis for the child’s social play. The model suggests that the child who is deficient early sensorimotor experience will not be as adept in constructive and social aspects of play as the child who experiences adequate sensorimotor play.

3. Higher levels direct and organize the lower levels. As the hierarchy is ascended and the focus of the child’s play changes in complexity, the lower levels continue to be refined while the higher levels predominate. For example, the emphasis of the 6-year-old’s play is clearly social in nature, yet the refinement of constructive as well as sensorimotor skills continues to occur within the context of this social play.

4. A change at one level affects all other levels. The child whose early sensorimotor experience is lacking may find constructive and social play affected as well. Conversely, treatment experiences directed toward changes at one level of play may result in changes at other levels.

It bears re-emphasizing that competence is generated at each level of the model. This model attempts to integrate theoretical aspects of play as viewed by both occupational behavior and sensory integration practitioners. The child whose sensory integrative functions are intact, who freely explores the constructive aspects of the environment, and who successfully experiences the social spheres of the world through the vehicle of play will become a competent actor in the environment. Competency is a product of evolution, development, and learning, and is critical for adaptation.

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Robert W. White defined competence as effective interaction with the environment: “To be competent means to be sufficient or adequate to meet the demands of a situation or task.” (34, p 273)

Ayres suggested that the child who is able to integrate sensory input effectively experiences the end-products of self-esteem, self-control, and self-confidence (4), all crucial aspects of the competent child Reilly (55) viewed competency as a biological and social phenomenon: biological because it is a human behavior that becomes increasingly complex with the development of the child; social because it is gained through successful interactions with others in the environment. She wrote that it is the openness of the system—the constant flow of energy and information via feedback loops—that allows adaptation, purpose, and goal seeking. She further suggested that the laws of processing behavior via this feedback arrangement may offer new avenues for understanding competency.

**Sensorimotor Play**

The first feedback loop of the model of play development concerns sensorimotor play, defined as intrinsically motivated, pleasurable activity involving exploration of sensation and movement. In the first year of life, the child is especially a sensorimotor being, acting in response to sensation arising from the body and the environment. As the child organizes sensation and responds appropriately to it, the central nervous system (CNS) becomes more organized. This is the process of sensory integration, the organization and interpretation of sensation for an adaptive response (4). Heredity provides the infant with a variety of innate adaptive responses in the form of reflexes (4). Thus, in the first feedback loop of sensorimotor play, sensation from the body and the environment as input is received and organized by the infant’s CNS as throughput. This process results in a reflexive adaptive response as output. The adaptive response is an indication that the CNS is organizing the input effectively. It must be remembered that even at this early stage, sensory feedback from the reflexive response acts to modify these innate mechanisms, resulting in more complex behavior. The child’s active exploration of the environment is a primary facilitator of this process.

Of particular importance in the processes of organization and integration at this level are sensations arising from the infant’s tactile receptors, proprioceptors, and vestibular receptors. These senses have begun their development in utero and, in some respects, are fairly well organized at birth. Adaptive responses to sensations of gentle body movement, of touch, and from muscles and joints are essential to the increasing organization of the CNS. Without the integration that occurs in this process, adequate development would be impossible in later stages (4).

The adaptive response is a successful response to an environmental demand. This process is not a passive one; rather, the child plays an active role in seeking environmental interactions that encourage more complex adaptive behavior. It is this “intentionality” of the child, or the active role played in seeking environmental interactions that facilitates the emergence of adaptive responses of greater complexity. This constructive exploration (4) is a critical aspect of the adaptive response.

This process of receiving sensory input, integrating it, and responding adaptively to it continues throughout the life span. Because of the sensory feedback generated during the execution of an adaptive response, the organization and integration processes as well as the following adaptive responses become increasingly complex. With this increasing complexity, sensations are organized into perceptions and meaning is given to the input. Perception is defined as the interpretation of sensation based on one’s experience. For example, the infant’s sense of sight is not very well organized at birth. With continued contact, the infant learns to recognize the primary caregiver’s face, that particular set of visual stimuli, as significant. With continued experience, the infant interprets the sensations and one of his or her earliest perceptions is “mommy’s face.” This describes the second feedback loop of the sensorimotor level. Sensation continues as input. Interpreted in the light of experience, sensation becomes perception, the throughput. Adaptive responses continue as output, but behavior is no longer as reflex bound as it was earlier. It is at this level that sensorimotor play begins to emerge, involving exploration of sensation and movement.

It must be re-emphasized that, even though the young child spends the early part of life engaged primarily in sensorimotor play, early social play also occurs at this level. As the child and caregiver become engaged in early social interactions, they may influence sensorimotor development at this level. If deficits exist in early caregiver-child interactions, sensorimotor play, in turn, may be adversely affected. If, on the other hand, the caregiver presents an adequate model of playfulness,
including appropriate social interactions, sensorimotor play may be enhanced.

An early perception developing at this time is the infant's body scheme. This is the perception of one's body parts, their relationships, and how they move. It requires the continual integration arising from movement, from touch, and from muscles and joints. This body scheme contains information about each body part: its size, its weight, how it feels, and how it moves (4). As a result of this developing body scheme, an output that emerges at this level is a beginning form of imitation. The infant is now able to reproduce familiar body movements. With further development, the child is able to reproduce unfamiliar gestures (36).

Some of the sensations arising from this new-found ability to imitate act as feedback to modify and refine the infant's body scheme. As this happens, the infant begins to be able to conceive of and organize a sequence of unfamiliar actions. This is praxis, or motor planning, as defined by Ayres (4). The adaptive motor response that emerges as output at this level is then a nonhabitual action. The development of motor planning permits play development to progress to the final feedback loop of the sensorimotor level. As the child repeats nonhabitual movements, the resulting sensation is processed into knowledge about how the body moves through space. Robinson suggested that the infant is developing rules of motion (24). These are defined as mental representations of how one's body moves through space. With the repetition of movements, the child learns the sensorimotor rules about how the body operates. Eventually, some of these movements become automatic motor skills, or actions requiring no motor planning or conscious attention. They are habitual actions, for the child has mastered them and no longer needs to direct attention to their performance. Examples of motor skills could include drinking from a cup, walking down steps, and riding a tricycle. Iterated, sensation arising from the practice of nonhabitual motor actions assists in the learning of rules of motion that allow for the development of motor skills.

In summary, sensorimotor play allows the child to achieve a number of things, not the least of which includes a more organized brain. The infant's experience allows sensation to be processed into perception. Perception includes the development of a body scheme and praxis, both of which contribute to the development of imitation. Finally, rules of motion are mastered, thus allowing the emergence of automatic motor skills. Sensorimotor experiences continue to develop and contribute to competence as play progresses into constructive and social levels of development.

Constructive Play
The second major level of play in this hierarchical model is that of constructive play. Constructive play is defined as play that involves the combination and/or sequencing of objects in time and space. Most theorists and researchers of play development agree that this kind of play begins to predominate during the second year of life (36-39). It continues to develop as an important part of play throughout the preschool years.

The beginnings of constructive play occur during sensorimotor play. Becoming more mobile, the child contacts objects with greater frequency. During the first year of life, most of the infant's play with objects is sensorimotor and focuses on action and sensation. The first actions with objects are gross and do not vary much from one object to another. If given an object, the infant is apt to bang it or mouth it. But as motor skills and perception are refined, the properties of objects are explored in actions. The infant may reach for an object and manipulate it while carefully examining it. Actions with an object begin to show that the infant is aware of its properties (36). The child is learning the rules of objects. Robinson defines rules of objects as knowledge about the properties of objects (24). When the infant "knows the rules" about an object, he or she can anticipate what an object will do when it is acted upon. Learning the rules of objects is a critical process for beginning constructive play because the properties of objects must be known before objects can be combined effectively. Early constructive play begins when the child spontaneously and intentionally combines objects in simple ways—for example, by putting one object inside another or by placing one block on top of another. This first feedback loop of constructive play, then, involves objects and materials as input, and learning rules of objects as throughput; the output is combining and sequencing objects in play. Feedback arising from these activities helps the child continue to enlarge the repertoire of rules of motion and objects. Feedback also stimulates the development of cognitive processes.

Imagery is one such cognitive process that, in turn, influences constructive play (40). Imagery is the ability to visualize objects and events mentally. A 1-year-old child is using imagery when he or she
combines objects that have been seen together as a set before. For example, the child may put a spoon in a toy cup and then pretend to eat from it. Such pretend play using objects starts as single actions, and gradually increases in complexity as the child links actions into longer sequences. The work of Lowe has shown that during the second year of life, pretend play with toys not only increases in complexity of sequences, but also shifts from actions centered on the self to actions centered on a doll. Sequences also evolve from single actions to a series of actions in logical temporal order (37).

Imagery also underlies the development of deferred imitation during the second year of life. In deferred imitation, the child can retain a visual image of another’s actions and imitate it at another time. Now the children are often onlookers of others’ activities and may later imitate when the model is no longer present (36).

When the child’s cognitive abilities develop to the extent that new relationships between objects are perceived, imagery becomes a critical process in the development of problem-solving and tool-use skills. This brings us to the next feedback loop in constructive play, the input (objects) is processed by using imagery to produce observable problem-solving and tool-use behaviors in play. At first, the child uses an overt trial-and-error approach to solve problems. During the second year of life, the process of imagery develops to the extent that the child can visualize attempting different solutions before actually trying one. Simple tool use also emerges; for example, using a stick to obtain an out-of-reach object (36). In these situations the child relies on earlier throughputs of perception, rules of motion, and rules of objects in order to achieve success. The ability to visualize relationships between objects makes the child more likely to use tools and attempt to solve problems. These actions, in turn, provide feedback that leads to the refinement of fine motor skills, perception, and cognitive functions.

By the time the second birthday is reached, the child is beginning to use real symbols in play. In symbolization, one thing is used to represent something else not present. A symbol may be an action, object, mental image, or word (40). The last feedback loop in constructive play, according to this model of play development, involves the new throughput of symbolization. Imaginative fantasy play is the output when symbols are used in complex sequences. Often this may involve pretending an object is present when it is not, or substituting one object for another while enacting a dramatic sequence. An example might be a child preparing a tea party for dolls. By now, the child is able to focus attention for longer periods of time, and play shows evidence of more elaborate spatio-temporal sequencing. To an outside observer the child’s play appears more organized and mature (36, 37).

To summarize, constructive play develops out of sensorimotor play as the child learns rules of objects and begins to combine and sequence them, first in single concrete acts, and later in longer elaborate play sequences. The development of imagery expands the play repertoire by contributing to deferred imitation, as well as to problem solving and tool use. By the second birthday, the child is able to symbolize and engage in truly imaginative fantasy play. Constructive play will continue to be an important part of the child’s play during the preschool years, both as a solitary activity and as a vehicle for the beginning of social play with peers.

Social Play
Social play emerges somewhere in the third year of life. It is defined here as play activities involving physical and/or verbal interactions with peers. Eckerman, Whatley, and Kutz described increases in social play throughout infancy until, at about 2 years of age, social play predominates over solitary play (41). Before this age, social interactions have primarily involved the child and another adult, usually the caregiver. An important product of these early child-adult interactions is the beginning development of social reciprocity as the child learns to play a more active role in social interactions (42). The development of reciprocity may be related to the development of rules of people, described by Robinson (24) and defined here as knowledge about the behaviors, and meanings of behaviors, of others. The infant initially does not have the appropriate rules of people to guide the social interaction. In this situation, the adult plays the major role in providing direction and meaning to the encounter. Such child-adult play sequences often have well-defined structures. For example, the game of peek-a-boo has a predictable sequence of interaction. Initially, the adult acts to provide the internal structure to the game. As the game is repeated in this same sequence, the child learns what behaviors are likely to occur and what an appropriate response might be (42). Now the child becomes a more active participant in social interaction. In this way, early child-adult interactions help the child to begin to interpret others’ behaviors and to

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predict how others will respond to them. Since there now is the beginning ability to derive social meaning from behavior, the child can initiate and participate in social interactions.

At this social level of play in the model, the child expands on the rules of people with reference to play with peers. As social interactions occur mainly around sensorimotor play and play with objects, adequate development of these lower levels of play is essential for the proper emergence of social play.

The primary input of the first feedback loop is the existence of people, especially peers, with whom to interact. Interactions with peers here result in the formation, and further refinement, of rules of people. These may involve imitation of others' behaviors and language as vehicles for communication in play. Social participation around a common play activity becomes possible as the child learns how particular behaviors may affect others, and what the behaviors of others mean. As rules of people are refined, the child gains a greater understanding of the possibilities of peer interactions and is able to engage in more complex cooperative social groups.

At a higher level of social play lies the input of cultural norms. These are formed from the child's observations of others engaged in culturally relevant role behaviors—for example, watching Daddy shave or a doctor perform routine duties. From these immediate social experiences, the child develops internal role expectations about behaviors and attitudes characterizing these roles; for example, internal knowledge of what a daddy does is formed. The child then becomes more aware of adult roles and enjoys enacting these roles dramatically with other children in sociodramatic play. Sociodramatic play is defined here as group play around a role-playing situation when each member takes on a different role, such as "playing house." The way in which a child plays a role is based on internal expectations, or the child's own understanding of that role. In addition, feedback from peers about the accuracy of role enactment may be received that will further modify specific internal role expectations.

Garvey (43) describes several values of sociodramatic play. These include a more flexible approach to situations and greater cooperative behavior and role-taking skills. Rosen (44) facilitated sociodramatic play in preschool children, demonstrating significant improvements in cooperative group problem-solving tasks as well as in role-taking skills.

Another more complex output at this level is the engagement in games with rules. These can be defined as institutionalized play activities that contain specific and publicly defined rule structures (e.g., jacks, hop-scotch). The child is able to engage in games with rules as a result of expanding abilities for cooperation within a social group, for planning and constructing longer action sequences in play, and for greater self-control for constraining actions within a rule structure. Sutton-Smith (45) described a developmental progression of games with rules that enhances the child's conception of social actions, social relations, and role-taking skills.

Through social play and games, then, the child is able to develop social skills expected of the age-role of preschooler: sharing, concentration, impulse control, taking turns, etc. In social play, the child gains valuable knowledge about the social world and begins to participate as an equal player in this social world. Thus, we see at this level of play the expansion of competence through the development of effective social skills, which are essential to the role of preschooler and which will continue to be important throughout the life span.

Summary
This paper has presented overviews of sensory integration and occupational behavior approaches, in addition to comparing and contrasting the two, to provide the background for a synthesis of these approaches within a model of play development. Differences between sensory integration and occupational behavior were found in the nature of assessment tools used, the areas of literature from which underlying concepts have been drawn, research emphasis, and specific treatment procedures used.

These differences highlighted the apparent incongruity of the two approaches; however, similarities central to occupational therapy goals and practice were identified that make possible the unification of sensory integration and occupational behavior approaches. These similarities include the concept of hierarchical development basic to each approach and identified as a critical concept within the model of play development. In the area of practice, therapists' structuring of the "just right" challenge, acknowledgment of the child's self-direction toward competent behavior, and the use of play as the process for development of adaptive behavior are critical commonalities. Finally, the therapeutic goal of competent performance of daily life tasks was identified as common to both approaches.

Sensory integration and occupational behavior concepts were syn-
thesized within a hierarchical model of play development. Three hierarchical levels of play—sensormotor, constructive, and social—were discussed using open systems concepts of input, throughput, output, and feedback. Each level of the hierarchy involves a separate arena of the child’s play experience. First, sensormotor play emerges, forming the basis upon which constructive, then social play is to flourish. Later, as the child matures, these constructive and social aspects of play increase. With normal development, each level will produce competent behavior; that is, with effective play at each level of the model, the child becomes competent in interacting with the environment. In a second paper, interrelation between sensory integration and play, implications for dysfunction, and suggestions for assessment and treatment are discussed.

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