Early Object Rule Acquisition

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The purpose of this study was to generate a descriptive theory of early object rule acquisition. The grounded theory approach and computer coding were used to analyze videotaped samples of an infant's and a toddler's independent object play, which produced the categories descriptive of three primary types of object rules: rules of object properties, rules of object action, and rules of object affect. This occupational science theory offers potential for understanding the role of objects in human occupations, for development of instruments, and for applications in occupational therapy early intervention.

A young therapist sits on the floor gazing in puzzlement at a new in-home patient, an appealing 10-month-old boy, Joey, who is regarding with uncertainty the few simple toys in front of him. Joey's condition has been diagnosed as developmental delay of uncertain etiology. Both he and his family seem receptive to the therapist. On the basis of evaluation and theory, she understands how she will facilitate development of the child's sensory and motor capacities. But what should Joey be learning about objects at this age? At most, he shakes a block now and then. How would an incomplete repertoire of object concepts influence his development in feeding, play, and negotiation of his environment? If Joey does not learn to explore and use objects skillfully, how will he perform in the later roles of student and worker? Where should this therapist start on object play?

Study Purpose

The purpose of this study was to generate a descriptive theory of early object rule acquisition through a detailed analysis of infant–object interactions in videotaped samples of the independent play of two nondysfunctional children. Rules of motion, objects, and people are symbols that codify experience and guide action (Reilly, 1974; Robinson, 1977). Object rules are internal constructions of meaning concerning objects in the environment. For instance, a young child may visualize the properties of a cardboard box with which he or she has played: its size, weight, and texture; the sound produced from kicking it; its capacity to be climbed on and hidden in; its usefulness for holding other objects; and its potential for being pushed and pulled around the room. These perceptions of the object are highly individualized and depend on experience. Rules have been cited as central constructs in conceptual models of occupational therapy knowledge (Kielhofner & Burke, 1980; Reilly, 1974; University of Southern California, Department of Occupational Therapy, 1989).

The present study was undertaken for the following reasons. First, knowledge needs to be developed to illuminate how objects are used in human occupations. Tools, toys, and aesthetic objects reflect and enact culture, especially in technological societies (Csikszentmihalyi & Rochberg-Halton, 1981). Objects provide the interface between human action and the environment, both constraining and facilitating human goals (Cowan, 1983; Csikszentmihalyi & Rochberg-Halton, 1981). No current theory specifies the abilities of children below the age of 2 years to conceptualize, carry out, and emotionally manage interactions with objects. As an initial step, I examined the natural use of object rules in infancy. The early object rule theory that resulted from this study contributes to occupational science's effort to build the original basic science that will best support occupational therapy (University of Southern California, Department of Occupational Therapy, 1989).
The second reason to explore object rule acquisition in infants was to lay the foundation for assessment of the developmental status of very young children through observation of their natural uses of object rules. Present developmental evaluations of children from birth to 2 years of age rely heavily on motor measures (Ungerer, 1979). Often these evaluations make demands on the child that are not age appropriate: demands for attention, for structured performances, for acceptance of unfamiliar persons and environments, and for complex interactive and cognitive abilities (Kalverboer, 1977; Ungerer, 1979). Play is the predominant occupation of babies, toddlers, and preschoolers. The strong relationship of play to development (Florey, 1981; Hutt & Hutt, 1970; Piaget, 1952, 1962, 1976; Rosenblatt, 1977) indicates the potential for an object rule instrument to detect developmental dysfunctions that are more evident in independent object play than in gross motor measures or structured performances. Although early object rule theory does not yet specify monthly developmental expectations for object interactions, this study provides initial steps in that direction. An instrument based on age norms for object interactions could also foster improved understanding of the occupation of play through research into individual differences due to such factors as culture, sex, disability, and environment.

Finally, it was reasoned that knowledge of the role of object rules in function could eventually contribute to early intervention. The play deficits of children with disabilities are documented in the literature (Gralewicz, 1973; Howard, 1986; Kalverboer, 1977; Mogford, 1977; Wehman, 1977). Early object rule theory could contribute to developmental treatment approaches, because occupational therapists adapt the normal play strategies of infants and toddlers to the goals of treatment. By understanding the child's affective responses to objects, one could more effectively manage the therapeutic environment to elicit adaptive responses. Play is accepted as a versatile and powerful occupational therapy modality; yet little data exist to support this claim (Sparling, Walker, & Singdahlisen, 1984; Vandenberg & Kielhofner, 1982; Wehman, 1977).

**Literature Review**

The existing literature did not supply descriptions of the developmental progression of object use in infants and toddlers in sufficient depth to support instrument development or hypothesis testing; for this reason, theory construction was chosen as the purpose of this study. The literature served to justify the need for theory development and the importance of object play. Although the theory of early object rule does not emerge directly from any other theory, a review of the literature guided the study's design and provided me with an informed approach to object play. Perspectives on the role of play in evolution, development, learning, and motivation were all used in planning for the study.

**Play in Phylogenesis**

Play exists in man through the natural selection of processes that increase successful adaptation (Bruner, 1965, 1972; Lancy, 1980; Reilly, 1974; Vandenberg & Kielhofner, 1982). Bruner (1972) asserted that a longer period of newborn immaturity resulted from contradictory selection pressures: pressures for a smaller newborn brain to enable passage through the bispelal pelvis and pressures for a larger adult brain for fine hand coordination. The limits of individual cognitive development thus became dependent on cultural methods of child rearing, which were as subject to natural selection as any morphological trait (Bruner, 1965, 1972; Fagen, 1976; Vandenberg & Kielhofner, 1982).

Humankind's technical-social culture requires play for transmission and innovation (Bruner, 1965, 1972). Tool use requires exploratory learning in a pressure-free situation and results in a reproductive advantage within evolution (Bruner, 1965, 1972; Vandenberg & Kielhofner, 1982). As the future becomes more difficult to predict within a single lifetime, the innovative, problem-solving function of play will become increasingly important (Bruner, 1972; Lancy, 1980). The literature on the role of play in evolution demonstrates the importance of play in shaping human culture.

**Play in Ontogenesis**

**Neurobiological Development.** Ayres's (1963, 1972, 1979) theory of sensory integration addresses the neurobiological basis of learning, acknowledging the influences of biological conditions, environmental demand, individual self-direction, and the mental development resulting from activity. Normal sensory integration provides abilities with which to maintain stability and attention, interpret sensation, and move skillfully through space, all of which are necessary to infant-object interactions. Ayres's (1963, 1972, 1979) research was regarded in the present study as the theoretical base of rules of motion. The repertoire of object rule strategies for potential actions on objects contributes to Ayres's (1979) work on the ideation phase of praxis.

**Cognitive Development.** The principal literature on children's play and cognition is by Piaget (1952, 1962, 1976). Piaget asserted that play is the observable product of the child's thought processes (1952). Intelligence is an adaptation, a relationship between the organism and objects in its environment (Piaget, 1952). An act of intelligence is the equilibrium of two processes. Accommodation is the adjustment of the child to reality, as seen in the child's learning about the world through play. Assimilation is the fitting of reality to the child, as seen in pretend activities.

Piaget’s (1952, 1962, 1976) theory of intelligence is built around the schema, which is a cognitive representation of interactions with the world. Schemata are interconnected in meaning and intercoordinated in action, and they operate at several levels of abstraction. Schemata range from modeling single, simple acts to representing whole systems of abstract thought (e.g., mathematics). According to Piaget (1952), only preliminary schemata exist from birth to 2 years of age.

How, then, do the concepts of rule and schema compare? Rules are defined as symbols that codify experience and guide action (Reilly, 1974; Robinson, 1977). This differs markedly from Piaget’s (1962) earlier use of the term rules as the socially defined structure of older children’s games. Rules (Reilly, 1974; Robinson, 1977) and schemata (Piaget, 1952) both accept the child’s development as a construction of the meaning of reality through interaction with the environment.

Given Piagetian theory, why was development of early object rule theory necessary? Discriminative operationalization of concepts such as assimilation, accommodation, equilibration, and schema is difficult and obstructs the research process. Glaser and Strauss (1967) identified this as a common problem in attempts to apply formal theory to substantive phenomena. The differences between these two perspectives on object play lie primarily in the Piagetian focus on cognitive dynamics, with little theoretical description of the corresponding observable aspects of the interaction or the influence of the natural environment. In contrast, early object rules are constructed to enable direct observation without constructed tasks or environmental manipulations and to address the effect of the environment.

Empirical research based on Piagetian theory offers the most refined classifications of play in the first 2 years of life (Belsky & Most, 1981; Fein, 1981; Fein, Kagan, Kearsley, & Zelazo, 1976; Fenson & Ramsay, 1980; Golomb, 1980; Largo & Howard, 1979; Lowe, 1975; Nicholle, 1977; Ungerer, 1979; Zelazo & Kearsley, 1980). The categories, however, are not as exhaustive or descriptive as would be necessary for developmental instrument design. Their linearity necessitates a choice between categories without allowing for complexity of performance. For example, if one applied the most detailed available categorizations (Belsky & Most, 1981) to samples of natural play with objects, actions of complexity ranging from shaking a rattle to riding a tricycle would fall into the category of functional play. This further supports the need for the discrete descriptive categories of the theory of early object rules in order to differentiate between natural object interactions at different developmental levels.

Social development. Children learn the rules of social interaction and practice roles through imitative and sociodramatic play (Reilly, 1974; Robinson, 1977). Studies have also shown correlations between play and language development (Fein, 1979; Israel & O’Leary, 1973; McCune-Nicholich, 1981). Theories of play and social development would primarily contribute to an understanding of the acquisition of rules of people (Reilly, 1974). The empirical literature supports the validity of this separation of social and object cognition (Emmerich, Locking, & Sigel, 1979; Johnson, Erschler, & Lawton, 1982; Pellegrini, 1982; Schultz, 1982). In the present study, therefore, I looked at independent play in an effort to access object rules over social rules.

Play Motivation

The literature on play motivation was examined to inform the study’s design and to gain understanding of the child’s affective experience of object interactions. I was guided through the multiplicity of play theories (and their approaches to motivation) by searching for congruence with the central concepts of occupational science. In general systems theory, which is accepted in occupational science as useful for organizing complexity, the motivation of open systems is termed negative entropy, which is the tendency of open systems to seek input leading to increasing complexity of the system (Von Bertalanaffy, 1975).

A three-part hierarchical construct corresponding to the three types of rules (Reilly, 1974) provided a tentative perspective on the motivations resulting in rule acquisition. Lowest in this hierarchy was the drive for sensory integration, which was thought to fuel the acquisition of motion rules. This yielded only to primary biological drives for the maintenance of body function and integrity, such as hunger and thirst (Ayres, 1972, 1979). Highest in the tentative motivational hierarchy was competence motivation, that is, the drive to gain the capacity to deal effectively with the environment (Smith, 1974; White, 1971). Competence was proposed as the motivation for the acquisition of social rules, because beliefs in self-competence or self-incompetence require the child to compare his or her own performance to either socially acquired expectations or to valuations by others.

At the middle level of the hierarchy, the drive to maintain an optimal arousal level (Berlyne, 1965; Ellis, 1973) was tentatively proposed as the motivation for acquiring object rules. Berlyne described conditions of novelty, complexity, incongruity, or surprise, dubbing these comparison situations resulting in arousal “collative variables” (Berlyne, 1965, p. 245). Research reveals their potency in increasing attention span, activity level, and exploration in children with and without disabilities (Berlyne, 1965; Cantor, 1963; Eson, Cometa, Allen, & Hanel, 1977; Henderson & Moore, 1980; Hutt, 1966; Piaget, 1952). The child seeks out pacers objects that are optimally arousing, that is, neither insufficiently challeng-
guided by the assumptions of occupational science. Dick-off, James, and Wiedenbach (1968) warned against advancing scheme development, data coding, and final synthesis of the theory's structure were suggested as the data were coded, although the greatest amount of effort at that time was in the coding process. Each phase of analysis was supplemented by the writing of memos, which were focused notes summarizing issues or progress in that phase.

Subjects and Procedure
The primary subjects of the study were a 6-month-old boy and a 16-month-old girl. These two normally developing middle-class Caucasian children were selected to give samples of extreme differences in infant object play due to age. Defining play from the perspective of the individual child was critical to the study of object rules, because rules are phenomenological constructions of meaning from experience.

The self-directed and environmentally sensitive nature of occupations mandated sampling independent play in natural home settings. Videotaping was selected to record the mercurial infant-object interactions in order to preserve the rich complexity of the object play and prevent the preliminary sifting of concepts that can occur in the use of field notes or checklists. Procedures were tested through the videotaping of 2 pilot subjects. The play of the selected subjects was videotaped for 35 min, twice a month, for 3 months. Videotaping took place in as natural a setting as possible, such as in the child's home or yard with usual playthings and with a caregiver present. The parents were made aware of the need for samples of independent, unprompted play without unusual levels of novelty. Observations on the taping session were recorded immediately after each session, which involved the noting of the subject's name, the date, ideas for consideration, and my reactions.

Data Analysis
Data analysis proceeded through phases of coding scheme development, data coding, and final synthesis of the theory. Although these phases occurred in a general sequence, they overlapped in time. For example, the initial formulations of the theory's structure were suggested as the data were coded, although the greatest amount of effort at that time was in the coding process. Each phase of analysis was supplemented by the writing of memos, which were focused notes summarizing issues or progress in that phase.

The first phase of analysis, development of the coding scheme, produced a taxonomy of all directly observable aspects of infant-object interactions. This was accomplished through an extensive series of visual comparisons of videotaped play samples of extreme likeness and difference, with the aim of fully defining everything about the child, the play object, or the environment.
that was pertinent to object rule acquisition and that could be coded for analysis. The videotape examination was coupled with the writing of memos that (a) summarized progress in coding scheme development, (b) outlined plans for carrying out the methodology, and (c) posed questions to be resolved. Issues of thorough description, mutual exclusivity of categories, and definition of the characteristics to be coded within each field were tackled in this phase.

The coding scheme consisted of the fields that organized the coding, operational definitions of the fields and their conditions, and a coding guide designed to list all conditions to be coded in each field and their abbreviations for entry. After many drafts, the validity of the proposed coding scheme was checked against the literature and with expert consultants. Procedures for the application of the coding scheme were then tested and refined through coding of the pilot videotapes. The resulting computer spreadsheet was headed, from left to right, by the field names listed in Table 1 and had a nearly infinite data capacity.

The second phase of data analysis was the application of the coding scheme to the videotaped play samples in order to generate the conceptual categories of the theory. A record (a single line of data entered from left to right in any or all of the fields of the form) was made for every action the child performed on an object. The actual entry of codes into the computer was accomplished in quick alternations with viewing the videotape and noting emerging concepts, relationships, and questions. A full discussion, in memos, of these jotted coding notes was completed after the coding of each videotaped play sample.

The coded data from the 12 videotapes contained 2,355 records. Coding expedited access to the data. In a process similar to that of coding scheme development, discovery and definition of the categories composing the theory proceeded through an extended series of examinations of samples of extreme likeness and difference. For example, by using the code for number of objects (under the action complexity field), I could compare all interactions of the subject with multiple objects for the purpose of generating descriptive differences. This is truly “theory as process” (Glaser & Strauss, 1967, p. 32), because the researcher’s microanalysis of the data produces first the superstructure of the general theoretical categories and then the subcategories.

The last phase of analysis was clarification and delimitation of the theory of early object rule acquisition, as guided by criteria for the adequacy of theories established by Bateson (1972), Glaser and Strauss (1967), and Reynolds (1971). The synthesis and revision of visual models depicting the general categories of the theory framed the primary relational hypothesis of the theory that a developmental progression of object concepts was being depicted. Definition and outline of the central concepts of the theory served to detect ambiguous or confusing aspects of the structural description. The draft of a written description of the discovered object rules served to provide a lengthy clarifying discussion.

**Limitations**

Examination of potential sources of bias is used in qualitative research to ensure the validity of data. The child’s and the caregiver’s awareness of the video camera and of the researcher may have influenced the play samples. My use of my daughter as a subject would be considered nonobjective in quantitative research strategies. In qualitative approaches, such intimate knowledge of subjects is considered both an asset and a threat to validity; it is invaluable, but only if carefully monitored (Emerson, 1983). The description of object rules also relies on the interpretative

**Table 1**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Coded Under Field</th>
</tr>
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<tbody>
<tr>
<td>Log ID</td>
<td>The identifying code for subject, session, and point on videotaped numerical log.</td>
</tr>
<tr>
<td>Log length</td>
<td>The length of the infant-object interaction on numerical log.</td>
</tr>
<tr>
<td>Codable play</td>
<td>Whether tape segment contained independent object play.</td>
</tr>
<tr>
<td>Object affect rules</td>
<td>Notes on apparent object rules regarding object associated with objects (for example, a child’s awareness of the need for caution).</td>
</tr>
<tr>
<td>Child affect</td>
<td>Child’s affect and physical conditions influencing affect.</td>
</tr>
<tr>
<td>Rules of object actions</td>
<td>Notes on potential object rules regarding action on objects (for example, an action sequence the child is using).</td>
</tr>
<tr>
<td>Action novelty</td>
<td>Conditions of the action that indicate its apparent newness or surprisingness (as when the mother notes a novel act).</td>
</tr>
<tr>
<td>Action complexity</td>
<td>Features of the action that indicate its degree of simplicity or complexity (number of objects, number of repetitions, variations on actions).</td>
</tr>
<tr>
<td>Action properties</td>
<td>Descriptive characteristics of the action (position, grasp, distance from object, speed, force, vocalizations, other descriptors).</td>
</tr>
<tr>
<td>Child’s actions</td>
<td>Name the actions and number chronologically for reference.</td>
</tr>
<tr>
<td>Object</td>
<td>Any discrete nonhuman entities to which the child attends, numbered.</td>
</tr>
<tr>
<td>Object properties</td>
<td>Passive attributes of objects (texture, shape, size, flexibility, etc.).</td>
</tr>
<tr>
<td>Object complexity</td>
<td>Features of the object that indicate its degree of simplicity or complexity (movable parts, recognized symbols, other descriptors).</td>
</tr>
<tr>
<td>Object novelty</td>
<td>Conditions of the object that indicate its apparent newness to the child (e.g., parent comment).</td>
</tr>
<tr>
<td>Action changes object</td>
<td>Changes in object attributes from child’s perspective (noise, movement, breakage, disappearance, etc.).</td>
</tr>
<tr>
<td>Object property rules</td>
<td>Notes on potential object rules regarding properties of objects (e.g., awareness of the object’s noisemaking potential).</td>
</tr>
<tr>
<td>Influences</td>
<td>Any physical-, human-, or event-related conditions of the setting that may be influencing the infant-object interaction (e.g., mother arriving home during tapings).</td>
</tr>
</tbody>
</table>
tion of primarily nonverbal infant behavior, which is a difficult task. The small number of subjects could influence findings through differences in age, sex, culture, family values, or socioeconomic status. Replication of the study with a larger, more diverse sample will refine and reduce bias in the theoretical categories.

Summary of Methodology

The methodology was guided by occupational science and involved a qualitative grounded theory approach. Videotaped samples of independent infant object play at home were gathered. The data analysis proceeded through phases of coding scheme development, data coding, and final synthesis of the theory. Computer database coding maximized the capacity for detailed comparative analysis. In-depth examination produced the structure of categories and subcategories that describe early object rules. The use of a systems approach to organizing the complexity of play (Reilly, 1974) yielded a hierarchy of developmental acquisition in three symbiotic types of object rules: object property rules, object action rules, and object affect rules.

Results: The Theory of Early Object Rule Acquisition

The early object rules derived from the methodology just described fall into three conceptual categories: rules of object properties, rules of object action, and rules of object affect. The three kinds of object rules develop in interaction from early and simpler static images to increasingly complex dynamic images. Before defining and detailing the development of each type of object rule, I believe it is important to understand their systems organization.

Systems Organization

The description of early object rules was organized through structuralism (Piaget, 1970) and dynamical systems theory (Von Bertalanffy, 1975). Structuralism, the European parallel of American systems theory, posits that a structure is an essential whole defined by laws of composition, that it is a system of transformations, and that it is self-regulating. Dynamical systems theory describes developmental processes, delineating both the internal structural changes and the external functional output of systems. Accordingly, these two models portray early object rules (see Figures 1–3). Referring to these models will assist the reader in accessing the developmental relationships of the object rule categories, because it can be difficult to assimilate a series of original definitions. It is also useful to visualize the child’s building of a repertoire of object rules as a gradual accretionary process resulting from experiences with objects.

Figure 1. Internal organization of early object rules.

Rules of Object Properties

Rules of object properties describe the child’s internal representations of the static and active characteristics of objects. These images of the passive and active attributes of objects are built up through experiences with objects, often in play. A child who has a rich and varied range of interactions with objects can be expected to have a more complete repertoire of rules of object properties.

Static object image. This encompasses the relatively unchanging aspects of an object the child has experienced, including shape, size, texture, temperature, weight, color, and opacity. Of the usual playthings observed in the study, the younger child tended to play with lightweight objects of less than 6 in., either round or cubic, and of smooth and hard or fabric textures. The older child’s play objects showed a wider range of characteristics, especially in her fascination with very large objects and tiny discoveries of a bug or a forgotten bit of crayon. The child’s use of the static image is demonstrated in object recognition and differing responses to novel objects and possibly in later formation of conceptual sets (e.g., color matching).

Dynamic object image. The dynamic object image includes the changeable characteristics of the object that the child superimposes on the static object image through experience. The dynamic image levels of object property rules, in developmental progression, are independent response properties, direct response properties, and combinational response properties. In the videotape data, object change is seen in sound production; shape change; and change in the spatial relationship of the object to the child, to the setting, and to a hybrid of both the child and the setting (see Figure 2).

Independent response properties. These properties of the object image are the dynamic aspects of the child’s constructed object images that are not the result of the child’s actions. In the present study, such objects as a strolling house cat or a fluttering butterfly offered independent response properties. This advertisement of the
Object Rules

Object Changes

<table>
<thead>
<tr>
<th>Object Rules</th>
<th>Object Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound</td>
<td>Change in Sound Relation to Child</td>
</tr>
<tr>
<td>Production</td>
<td>Change in Spatial Relation to Environment</td>
</tr>
<tr>
<td>Shape</td>
<td>Change in Spatial Relation to Environment</td>
</tr>
<tr>
<td>Change</td>
<td>Change in Spatial Relation to Environment</td>
</tr>
</tbody>
</table>

**Figure 2.** Examples of dynamic object property and object action rules. *Not observed in data, but examples have been provided.*

Object's active properties attracts the child. Some remote objects, however, such as a noisy airplane, intrude on the child's awareness but remain inaccessible.

**Direct response properties.** These properties arise from the action of the child on a single object, for example, the child's understanding that a property of balls is that they roll away when pushed. One commercial toy in the study that offered multiple sites for direct responses was a busy box with a horn to beep, a gear to spin, beads to push along a rod, and a bell to ring (by means of a lever). Some objects (e.g., a play mower) appear uniquely solitary and are unlikely to be used in combinations. This restricts most of their perceived properties to the level of direct responses. (See Figure 2 for a demonstration of the five types of direct response properties.)

**Combinational response properties.** These are aspects of the dynamic object image due to the child's action with multiple objects. There are three developmental types. **Approximation properties** arise from the use of two objects in generally equal ways, such as the clashing of cymbals. Of special interest here is the existence of approximation sets, which are object groups designed for extended complex versions of this type of play (e.g., building blocks, puzzles). The child's ability to disassociate approximation sets develops earlier than the ability to assemble them. This produces a trend toward a homogenous object mix in play environments, as the building blocks and puzzle parts sift together to the bottom of the toy box. The approximation properties describe the clashability, stackability, and combinability of the objects. **Simple tool properties** require the use of one object on another, such as cutting colored modeling dough with a knife. In this example, the learned simple tool properties are the cutability of the dough and the cutting function of the knife. Certain large objects function uniquely in supporting simple tool object combinations. For example, a wading pool or low table can serve as a catalyst and work site for infant interactions with a series of objects— a pattern of activity with objects that extends into adulthood. **Complex tool properties** are discovered through the use of one object to change the relationship between two other objects (e.g., hammering a nail into a board). Each of these types of combinational response properties is demonstrated in the cells of Figure 2, although complex tool properties are more typically seen in the play of children older than those used in this study.

**Social overlay to rules of object properties.** Socialized object properties are those that must be interactively acquired; they are culturally defined concepts that come to be attributed to the object. Language labels of objects, their parts, and their attributes were observed in the data. These are not object rules per se, but they demonstrate the blending of rules of objects and rules of people. An example would be the perception that snakes are slimy, a common socially acquired (and inaccurate) object concept.

**Summary of rules of object properties.** Rules of object properties are the child's construction through experience of the static and dynamic images of objects. They are acquired through active exploration and develop in complexity over time. Differences in play environments can be examined through rules of object properties with the use of the taxonomy to inventory the object interac-
Rules of Object Action

Rules of object action, the second primary object rule type, are the child’s internal representations of actions on objects. Rules of object action are sensory memories of physical performance, rather than the more external constructions of object images in object property rules. The structure of object action rules roughly mirrors that of object property rules, because the strategies are matched to the object characteristic being explored by the child (see Figures 1 and 2). Action images may be more or less associated with the object images with which they were paired in experience, depending on the age of the child.

**Static image strategies.** The lowest level of object action rules involves the static image strategies—actions to obtain information regarding the shape, size, texture, temperature, weight, color, and opacity of an object. These actions include object gaze, still contact, grasp, mouth, feel, and texture tests. The texture test, discovered in the present study, is an attentive fingertip rubbing of a surface seen in infants, apparently used to examine unusual textures.

**Dynamic image strategies.** Dynamic image strategies are actions by the child to observe object response properties. They are of three types: transition actions, direct response strategies, and combinational response strategies (see Figure 1). As with rules of object properties, rules of object action were derived through the grounded theory method, that is, development of a descriptive taxonomy through constant comparison of extremely alike and unlike examples of actions on objects.

**Transition actions.** These actions maintain the object interaction through the child’s initiation, continuance, or ending of object interactions. They fall into three subgroups. **Preparatory actions** include orientation, search gazing, object approach, object and body positioning for interaction, and initial contacts. The degree to which these preparatory actions merge into a smooth unitary act increases with age. The initial contact is a momentary touch of the closest surface of an object on arrival, possibly serving to call up the object image and associated potential actions. **Direct response strategies** comprise the many simple object manipulations, such as ringing, squashing, climbing, pushing, and throwing. Of special interest in the younger child’s direct response strategies were the variety of non-grasp object contacts, the carrying of objects while crawling, the bimanual driving on the knees of broad smooth objects across the floor, the series of grasp adjustments necessary for awkward objects, the repeated lateral toss of objects in his path as he crawled, and a 5-min grasp chase of a slippery ice cube.

**Combinational strategies.** These include approximation strategies, simple tool strategies, and complex tool strategies (see Figure 1). They produce object changes, as illustrated in Figure 2. At all levels of complexity, rules of object action demonstrated action momentum, which is the tendency for an action to be carried through once initiated. Action momentum can be seen in an adult when he or she automatically puts away groceries while thinking of other things, only to realize that the jelly has been put where the mustard belongs. Once it was initiated, the action—putting away groceries—continued without close attention. Similarly, it is difficult for a child to quickly discontinue an action once it is begun.

**Social overlay to object action rules.** The overlap of rules of objects and rules of people appeared in both action naming and action modeling. Action naming was seen in the older child when she used gestures to communicate actions. Modeled actions are object interactions that are performed not to secure a response from the object or to explore its static properties but because that action has been observed in another person. For example, the younger child listened to a book after observing a telephone conversation.
Rules of Object Affect

Object affect rules describe the factors the child actively manages in order to keep the emotional experience of object interactions at an enjoyable level. They are the concepts used by the child in evaluating, selecting, and discontinuing actions on objects. In essence, object affect rules form the motivational component of the theory. The child calculates potential affective values by means of two formulas: One formula addresses objects and one addresses actions (see Figure 1).

Object affective value formula. The object affective value formula involves six factors that the child considers in deciding which objects to engage, how long to continue in an interaction, and when to discontinue interacting with an object. These six factors are (a) the sensory potency of the static object image, (b) the perceived responsivity of the dynamic image, (c) the object’s novelty in relation to the child’s experiences, (d) the object’s complexity in relation to the child’s experiences, (e) the way the object fits preferred actions, and (f) the objects just used. Sensory potency is the child’s realization of the amount of texture offered by the object. Object responsivity is the child’s perception of the ease with which an interesting response can be triggered from the object. Object novelty is the newness of object characteristics in comparison to the child’s experience, whereas object complexity is the degree to which an object offers new concepts to the child. (The power of novelty and complexity to engage the child can be seen in parental efforts to maintain these two factors by rearranging play spaces, rotating toys in and out of closets, and supporting the toy industry.) The way the object fits preferred actions refers to the object’s usefulness for currently preferred activities, such as teething or climbing. Last, the factor of preceding objects is the influence of a recently used object on the next object choice. The child’s increasing developmental sophistication in the management of these factors for a positive affective experience contributes to independence and success in object interactions.

Action affective value formula. The action affective value formula contains the six factors regarding actions that the child balances to determine the action portion of the affective experience of object interactions. These factors are (a) the sensory potency of the action, (b) the potential results of the action, (c) the action’s novelty, (d) the action’s complexity, (e) the action’s fit to the selected object, and (f) the influence of preceding actions. An example of a high sensory potency in an action is the feeling of spinning around a picnic umbrella pole. The effect of potential results from action was seen in the older child’s awareness of acts of daring. Action novelty and complexity are, again, determined only in comparison to the child’s history of actions on objects. Action complexity is also influenced by the degree to which a sequence of actions is being related. Action fit to a selected object is the way in which an already selected object influences the child’s determination of actions on it. The contribution of preceding actions is seen in the young child’s tendency to repeat an action on a series of objects. The summation of these factors yields the child’s choice of actions.

Social overlay to rules of object affect. The overlap of rules of objects and rules of people in the area of object affect was seen in (a) the influence of the caregiver’s affect on the child’s object interactions, (b) the child’s communications about feelings, and (c) the child’s moderation or enhancement of affect by sharing emotions with the caregiver. The older child depended less on the caregiver’s support to modulate affect in object interactions than did the younger child.

Summary of rules of object affect. By combining the object and action affective value formulas, the child loosely calculates which objects to select, which actions to perform on them, how long to continue, and when to cease interactions. In multiple examples of play data, this study has demonstrated the subtlety with which, through rules of object affect, the child manages his or her own affective experience to keep it within an optimal, enjoyable range.

Change Over Time

Object rule acquisition can be observed during interaction with one object, across the 35-min sample of independent play, and over the 3-month period of data collection. One example of change during an infant–object interaction was the increasing complexity of the older child’s actions with a set of wooden rings and pegs painted in primary colors. She first dumped the rings from the pegs; then tossed them around, clashed them together, and placed them randomly on the pegs; and then began matching colors in placing the rings.

Themes were often evident during a single taping session; for example, the younger child played primarily in a supported stand in one play sample, and the older child tried to carry every large object available during one of the sessions. Another pattern for the older child was a raised affective value for objects and actions in which she was unsuccessful. After a brief cooling-down period of interacting with easier objects, the child would return to the site of frustration and conquer her earlier failure with that object.

A general developmental trend of increasing complexity of early object rules was observed over the 3-month period. Further, the 2 subjects differed markedly in their object interactions. The younger child usually repeated variations of a limited repertoire of direct response strategies on a series of single objects within a small space and required high affective support. The older child performed combinational and sequentially related actions within a greater play range and was more
independent in affect moduation. These differences in complexity are tentatively attributed to age and development. Overall, this study appears to demonstrate the fine increments of acquisition of early object rules that could contribute to the understanding of infant acquisition of object rules and support the development of a naturalistic assessment based on object play.

**Environmental Interactions**

The child's acquisition of early object rules cannot be understood without considering the influence of the environment. The interactive view of early object rules (see Figure 3) models the primary considerations. Observation of the environmental conditions of noise level, temperature, air movement, and activities of other people in the area indicated that a quiet, comfortable play area appeared to be most productive for early object rule acquisition. A base of minimal caregiver support also resulted in the most intent object interactions. For the younger child, this involved a much closer proximity and higher frequency of contact than for the older child. More than minimal interaction led the children into more social interactions rather than independent exploration of objects. Of course, the availability of objects was also a critical factor, although less than two thirds of the play objects were commercial toys. The proximity of objects had a stronger influence on their selection for play for the younger child than for the older child. The constellation of these environmental conditions can enhance or detract from early object rule acquisition.

**Summary of Early Object Rules**

Early object rule acquisition is active, subjective, self-directed, and influenced by the environment. Detailed analysis of videotaped samples of independent infant-object play with the use of a grounded theory approach has resulted in the theoretical categories of early object rules. This does not imply stages of early object rules, but simply describes the growth of complexity in the child's understanding of objects. Degrees of complexity and depth of repertoire exist within each level of each type of early object rules. The richness of the child's understanding in each area can be expected to be related to the sufficiency of the child's experience of those object concepts, resulting in strengths in some areas and weaknesses in others.

**Future Research**

I plan to do future research in the area of object rules by focusing first on the replication of this study with a larger sample, spread in regular age increments from birth to 2 years. This will refine the theory and generate more specific age expectations for early object rules. Studies to test the validity of the theory through correlation with other developmental and play measures will be needed. A statistical analysis of the developmental progression of the acquisition of object rules will test the primary relational statement of the theory. Next, I will initiate the development of a naturalistic play instrument designed to assess early object rule acquisition. Such an instrument will enable more definitive studies of play differences due to sex, environment, disability, culture, or other factors. The relationship of play to adult occupations may also be supported by such research, because we observe in play the emergence of activity patterns that shape adult occupations.

**Implications for Practice**

Although it would be premature to base treatment solely on early object rule theory, some recommendations for practice can be made. Early object rule theory demands that occupational therapists examine clinical settings for their approximation to a natural play environment and question the differences they discover. Similarly, comparison of the independence, tempo, and sequences of natural object play to the dynamics of infant and toddler treatments involving objects may be informative. Are the differences between play and treatment always therapeutic, or do therapists at times trade tradition and efficiency for effectiveness? By understanding the pervasive influence of the environment on early object rule acquisition, we emphasize the value of in-home treatment. By examining the theoretical categories of early object rules with a particular child in mind, we may find gaps in treatment or fresh ideas for activities. Further, consideration of the way in which specific disabilities restrict object experience may illuminate areas in which supplemental or substitute activities might serve to improve abilities. Consideration of the factors of object affect rules may also help us address that difficult area of treatment dealing with motivation and learned self-modulation of affect. It is my hope that early object rule theory will enrich our understanding of play in all children.

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**References**


**Coming in June:**

- The 1990 Eleanor Clarke Slagle lecture
- Generalization of treatment
- The validity of the SIPT's constructional subtests
- Motor learning concepts in occupational therapy
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