Doris Bergen | Darrel R. Davis | Jason T. Abbitt

ROUTLEDGE

TECHNOLOGY PLAY AND BRAIN DEVELOPMENT

Infancy to Adolescence and Future Implications

A **Psychology Press** Book

TECHNOLOGY PLAY AND BRAIN DEVELOPMENT

Technology Play and Brain Development brings together current research on play development, learning technology, and brain development. The authors first navigate the play technology and brain development interface, highlighting the interactive qualities that make up each component. Next, they survey the changes in play materials and the variations in time periods for play that have occurred over the past 15-20 years, and then explain how these changes have had the potential to affect this play/brain developmental interaction. The authors also cover various types of technology-augmented play materials used by children at age levels from infancy to adolescence, and describe the particular qualities that may enhance or change brain development. In so doing, they present information on previous and current studies of the play and technology interface, in addition to providing behavioral data collected from parents and children of varied ages related to their play with different types of play materials. Significantly, they discuss how such play may affect social, emotional, moral, and cognitive development, and review futurist predictions about the potential qualities of human behavior needed by generations to come. The authors conclude with advice to toy and game designers, parents, educators, and the wider community on ways to enhance the quality of technology-augmented play experiences so that play will continue to promote the development of human characteristics needed in the future.

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Routledge
Taylor & Francis Group
NEW YORK AND LONDON

First published 2016
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

Library of Congress Cataloging-in-Publication Data
Bergen, Doris.
Technology play and brain development : implications for the future of human behaviors / Doris Bergen, Darrel Davis, Jason Abbitt.
pages cm
Includes bibliographical references and index.
1. Social psychology. 2. Human behavior. 3. Technology. I. Davis, Darrel (Darrel R.) II. Abbitt, Jason. III. Title.
BF698.95.B475 2016
155.4'13—dc23
2015005375

ISBN: 978-1-848-72476-1 (hbk)
ISBN: 978-1-848-72477-8 (pbk)
ISBN: 978-1-315-68143-6 (ebk)

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To the playful humans who enabled us not only to survive but also to flourish in past centuries and to the playful humans who will lead us into a future of expanded human possibilities.

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ACKNOWLEDGMENT

Our thanks to the parents and children who described the types of play that they enjoyed and shared their views on the value of both traditional and technology-augmented play experiences.

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INTRODUCTION

The Importance of Understanding the Brain/Play/Technology Interface

The authors of this book have approached the topic of effects of technology on brain maturation and social, emotional, moral, and cognitive development from varied perspectives, but they are in agreement that stakeholders, including parents, educators, psychologists, technology designers and implementers, as well as the greater community, should be collaborating to ensure that the technology-augmented play experiences of today's children and adolescents are well designed in order to facilitate growth and development that will give them the versatility and the resilience that they will need to meet future events. Presently, opinions on effects of intensive technology-rich environments on child and adolescent development and learning are varied and not always supported by research evidence.

The first author, Bergen, has discussed issues related to the potential effects of technology-augmented toys on young children's play for over a decade and conducted research on young children's play with such toys. With colleagues, she also has initiated a study of brain wave responses to video game play and written theoretical pieces speculating on effects of varied types of technology play on brain development. With co-author Davis, she also has explored the role child and adolescent play with real and virtual playthings may have on moral development. Davis has further explored the types of video and online play that college students report. Abbitt has studied effects of technology-enhanced learning materials in various educational contexts and, with Davis, has presented work on the effects of instructor texting to improve student learning. Thus, the impetus for this book has come from the authors' belief that it is important to address the interface between technology-augmented play and brain maturation, as well as other developmental areas, and to examine factors that might influence this interface both positively and negatively.

Research into the effects of technology-augmented play is controversial, with a number of writers pointing with alarm to the possibilities of harm from early and consistent exposure to technology-augmented toys and media, while other writers have described how these media can enhance human learning if designed and used appropriately. There has been scholarly work that has addressed both particular concerns and possibilities, but there has been no book that has comprehensively discussed the play/brain/technology interface issues addressed in this book. It is likely that technology-augmented play will have both positive and negative effects on brain maturation processes, especially if children and adolescents have extensive and long-term exposure to such play materials. Perhaps such exposure may differentially affect not only brain development but also the social, emotional, moral, and cognitive aspects of many other human behaviors. These changes may be useful and relevant at a future time and assist humans to adapt to future conditions or they may cause humans to lose abilities and skills that continue to remain relevant and essential for human life. Thus, the authors believe that a book that brings together current research knowledge on such developmental factors and explains how they may interface with the representation modes and affordances of various technology-based play materials has been needed to provide scholars and students with a perspective for further systematic research.

Scope and Sequence

Chapter 1 discusses how both play and brain development have nonlinear dynamic systems qualities, and describes the processes by which play development occurs and interfaces with brain maturation. It presents the theoretical view that cognitive understanding proceeds through enactive (motoric action with objects), iconic (linking perceptual images of objects), and symbolic (using language and other symbols to represent objects) levels (Bruner, 1964); discusses potential social, emotional, moral, and cognitive issues that play supports; defines technology; describes the nonlinear dynamic qualities of technology; and suggests how such qualities may interface with play and brain development. Chapter 2 describes the historical role of technology in the design of play materials and the changes in play environments that have occurred with the advent of technology-augmented play materials. It also reviews both a number of writers' perspectives on the potential positive and negative effects of this change in the play environment and evidence of such changes in play experiences drawn from research on adults' memories of their own play. The authors also describe the theoretical lens of "affordance" theory (Gibson, 1969, Carr, 2000) and "modes of representation" (Bruner, 1964). Further, the concepts of physical and virtual "contexts" (Milgram & Kishino, 1994) are used to analyze potential effects. Chapter 3 describes the various types of technology-augmented play materials presently being used by young persons from infancy to adolescence. It describes these affordances and contexts and suggests ways that physical and virtual technology contexts may have different affordances and contexts, which may result in varied effects on child and adolescent development. Chapter 4 describes the authors' research on young children's initial interactions with technology-augmented toys and video game play. It also presents the opinions of a group of parents, children, and adolescents about past play experiences and present day technology-augmented play. Their views of advantages and disadvantages of such play and its possible effect on various developmental areas are shared. Chapter 5 addresses speculations from futurists regarding the types of skills that humans will need in future life periods and examines those possibilities in relation to the skills that may be promoted by various types of technology-augmented play. The potential changes in human brain development and behavior that may occur due to the changes in play behaviors are described and evaluated. In Chapter 6 the authors provide suggestions for parents, educators and psychologists, technology toy manufacturers, digital game makers, online play designers, and community stakeholders that may promote healthy and future-enhancing brain development as children and adolescents engage in play with technology-augmented as well as traditional play materials.

The authors believe, as Emily Dickinson reminds us, that the brain is an amazing organ that defines us and our world. Thus, its fate in the future must be considered in a technology-augmented world.

> The Brain—is wider than the Sky—
> For—put them side by side—
> The one the other will contain
> With ease—and You—beside—
>
> The Brain is deeper than the sea—
> For—hold them—Blue to Blue—
> The one the other will absorb—
> As Sponges—Buckets—do—
>
> The Brain is just the weight of God—
> For—Heft them—Pound for Pound—
> And they will differ—if they do—
> As Syllable from Sound—

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BRAIN MATURATION AND TYPICAL PLAY DEVELOPMENT FROM INFANCY THROUGH ADOLESCENCE

Complimentary Dynamic Processes with Technology

The plane from San Francisco to Atlanta was crowded, with every seat filled. Tina (age 3½) was seated in the middle of a three-seat row, with her dad in the window seat and an older adult in the aisle seat. While the plane was boarding and taxiing for takeoff, Tina was talkative and wiggly and it seemed like this long flight would be very tedious for her. While her dad was getting her settled, she kept pointing to his iPad™, which he had put in the seat pocket and he reminded Tina a number of times that she would have to wait to get that until after the plane was in the air. Once the plane was on the way, he pulled out two little pink ear buds and put them in Tina's ears and then put the iPad on a Disney movie. Tina sat quietly in her seat absorbed in the movie for most of the rest of the trip. She did eat a snack and, during the last half hour of the trip, she dozed off. However, the iPad movie engaged her attention for over 2 hours! Her dad had very little talk with his daughter after the iPad took over.

Studies of the dynamic relationship among brain developmental processes, child and adolescent play experiences, and the influences of technology-augmented play materials are only in initial stages. However, it is likely that play development and brain development may be differentially affected by play with technology-augmented materials. What brain development effects will occur due to humans' pervasive interactions with technologically advanced materials is not a new question, however, as various theorists and researchers have speculated on it in the past.

For example, in pondering the course of cognitive growth and the reasons for the human evolution of large brains, Bruner (1964) drew attention to a paper written on the one hundredth anniversary of Darwin's (1859) publication of *The Origin of the Species* in which the authors asserted that the brain's development has occurred because of the "result of a technical-social life" (Washburn & Howell, 1960, p. 49).

Bruner proposed that intellectual functioning has always been driven by "a series of technological advances in the use of mind" (p. 1), which enabled humans to manage in increasingly complex environments and "construct models of their world" (ibid.). He hypothesized that over the long evolutionary period, humans have increased their intellectual power by learning to use and understand three types of technological artifacts: amplifiers of human motor capabilities (e.g., wheels, bicycles), amplifiers of sensory capacities (e.g., radios, magnets), and amplifiers of human ratiocinative capacities (e.g., language and other symbol systems)—all of which are transmitted by the culture in which humans live. Each of these has a "mode of representation" (p. 2). *Enactive* representation occurs through motor responses, which are the earliest mode of understanding. For example, young children's tricycle riding or block building involves motoric interactions with the environment and encodes knowledge in the muscles, and this knowledge can then be applied to other actions in the environment. *Iconic* representations involve the organization of images or models and the understanding that such pictures or images of perceptual events can "stand for" the actual environmental features. This is evident when a young child can point to a picture of "shoe" or "kitten" or find the "truck" or the "car" in a storybook. *Symbolic* representation begins when children can use an arbitrary symbol system such as language or numbers to encode meaning. This occurs when a child knows the symbol "Bill" stands for his name or can point to the symbol "3" to show how old he is. Once these modes of representation are learned, humans can produce combinations of images or actions that go beyond "real-world" experiences. In Bruner's view, this ability to "become specialized by the use of technological implements" (p. 2) has made the evolution of human abilities possible. If new technological artifacts give humans different interactive experiences, then future evolution of the human species through interaction with present day and future technologies is a definite possibility.

Views of the Play/Brain Relationship

The role playfulness may serve in fostering human brain and cognitive development has been of interest to various theorists such as Plato, who in his book of *Laws* (360 BC) suggested that children's play (*paidia*) had significance as a venue for learning and developing basic habits of character (*paideia*) (see Morris, 1998). At later time periods, the view that children's playful activity has educational and developmental meaning was emphasized by many theorists, including Comenius (1632, 1657), Rousseau (1792/1911), Froebel (1887), Dewey (1910, 1916), and Hall, (1920, 1924). In the mid-20th century, Huizinga (1950) wrote that playfulness is an integral behavior of the human species and thus he called humans *Homo Ludens* ("man, the player"). Huizinga's view of the evolutionary importance of play was also discussed by Ellis (1998), who asserted that playful behaviors positively influence the ability of biological systems to exhibit rapid adaptation when unpredictable events that threaten survival are encountered. Human existence has always been precarious and he suggests it is likely that humans who had the greatest range of adaptive behaviors to meet changing environmental or social conditions (i.e., the most playful humans) were the ones who were most likely to survive. In his view, that is why and how present humans have inherited their intensely playful qualities.

Researchers who have studied play in animals also have lent insights into possible play-brain connections. For example, Lorenz (1971) indicated that, for many animal species, the curiosity young animals exhibit in their play is a characteristic needed for expressing new behaviors in varied settings. He compared the play of children to the research of adult scientists. Fagen (1981), who wrote extensively about animal play, agreed, stating that such play is essentially "a biological adaptation for producing novel behaviors" (p. 36). Recently, researchers using brain imaging techniques with animals have studied how the "playful brain" evolved in both animal and human species. (Iwaniuk et al., 2001; Pellis & Iwaniuk, 2004). Their research shows that animals with larger brains compared to their body size also exhibit the most playfulness. Relevant to the question of technology-augmented play effects, Whiting and Pope Edwards (1988), after conducting cross-cultural studies of children's play, concluded that the types of play in which children engage are malleable due to social and cultural messages, thus reflecting the cultural meanings of the society in which it occurs. If this is the case, then the present day cultural messages promoted through technology-augmented play may make this the preferred type of play for young humans in the 21st century. Freysinger (2006), in discussing play throughout the life span, states that the types of human play that are exhibited are "situated in a specific historical time and the economic, political, religious, and social reality of the day" (p. 60). In a recent discussion of cultural neuroscience theory, Kitayama (2013) has explained that, because of the brain's neuroplasticity, brain activity patterns may differ when varied culturally sanctioned behaviors are elicited. Thus, it is possible that the play behaviors promoted in a technologically pervasive culture will have a lasting impact on children's brain structures and functions.

Although they did not tie play behaviors to specific areas of the brain, two prominent theorists who did describe specific developmental relationships between various types of play and cognitive growth are Piaget (1945, 1965) and Vygotsky (1962, 1967). From observations of his own children's play in infancy and his study of older boys' marble game play, Piaget closely linked the various stages of play development to the growth of cognitive and moral abilities. His view was that children used play to construct their knowledge of the world by trying to relate their new experiences to their existing cognitive schema and their developing thought processes. Vygotsky investigated ways that children's play fostered learning of their cultural language and he stated that, especially when children engage in pretend play, their spontaneous concept development is fostered, leading to growth in self-regulation and development of internal modes of thought.

These earlier perspectives on the potential role of play in affecting brain maturation and the development of human capabilities provide the background for present investigations, because, if, as these theorists have asserted, human survival skills, cultural meanings, and cognitive advancement are all linked to playful behaviors, then the types of play in which children and adolescents are engaging at the present time are likely to affect their cognitive and social-emotional development, their adaptability to meet cultural demands, and even their survival in the world of the future. That is why the question of how the changing play environment may both positively and negatively affect brain development and subsequent behavior adaptability for children and adolescents is of interest, as is the question of the potential effects of such technology-augmented play on the broader society of the future. Because the brain maturation process provides many opportunities for environmental affordances such as play materials and technological artifacts to affect the nature of the adult brain, it is important to understand the brain maturation process (Bergen & Coscia, 2001). A glossary with a list of definitional terms related to the brain and diagrams of basic brain and nervous system areas are included in the appendix.

Brain Maturation during the Child and Adolescent Years

In the late 20th and early 21st century, information regarding how the brains of humans and other creatures operate has grown exponentially, due to the invention of research techniques that can observe both the electrical and chemical processes occurring in the brain at various ages as well as the expansion of synaptic connections and subsequent pruning of neuronal structures from birth to adulthood. Because over 71% of human brain development occurs after birth and brain maturation continues until about age 20, the experiences children and adolescents have (including their play experiences!) profoundly affect the ways their individual brains are structured and, consequentially, the ways they will perform throughout the rest of life. Researchers have found some differences in the adult brains of various individuals who have pursued certain careers. While the brain does retain some plasticity throughout life and later experiences may affect brain structures and functions, there is no question that the experiences of the first

20 years of life have the greatest impact in determining which areas of the brain are more densely formed and activated and which areas are pruned more precisely before the brain reaches its mature state. The consensus of researchers is that both individual genetic and experiential factors are crucial in determining brain structure and function in adulthood. As the Hindu phase "Sarvam annam" reminds us, for the developing human brain, "everything is food."

Infant Brain Maturation

The sequence of brain development in infants and young children has been well charted by researchers during the past 20 years. At birth, the neonate already has about 100 billion neurons, which were created during the prenatal stage. The neuron has three major parts, a cell body, dendrites that receive information, and axons that transmit information. These neurons compose the majority of those that the individual will have throughout life, but many of them are not yet connected in neural networks. Only those needed for essential life processes are connected firmly at birth so the process of synaptogenesis (creating neuronal network connections) is of great importance during the first few years of life. If the brain is well nourished and adequately stimulated, each neuron can produce up to 15,000 synapses (Lezak et al. 2004) during early development. The brain's weight increases from about 1 pound at birth to 2 pounds by 1 year, partly due to the increase in synapses and partly due to the coating of nerve axons with fatty glial cells (myelination), which act to speed neural signals. Research has shown that the brain stem and cerebellum begin myelination first, before the cerebral areas, and that myelination of the frontal lobes continues into adolescence.

The occipital (visual) lobe of the cortex is one of the first parts of the brain that has rapid synaptic growth and, therefore, this is one of the first areas in which pruning (the loss of nonessential connections) takes place. This is why treatment for young children with vision difficulties usually takes place at an early age before the pruning process in the visual cortex is highly active. Synaptogenesis also is especially active during the first years in the parietal lobe of the cortex (motor and sensory brain areas), and this synaptic growth is clearly seen in the increasing sensory and motor behavioral skills that children develop in the first years of life enabling them to demonstrate "enactive" cognition.

Social development is promoted by the activation of "mirror neurons," located in the premotor cortex, which connects portions of the parietal lobe with the occipital lobe and various other areas in the cortical regions (Rizzolatti & Craighero, 2004). The function of these neurons seems to be to enable infants to transform visual information into understanding of the actions of others by engaging them in the imitation of the observed behavioral acts. This infant understanding usually occurs first in interaction with parents or others in their social world, but young children's understanding of the actions of objects (e.g., toys) also seems to be derived from this mirror neuron system (Bergen & Woodin, 2010). In Bruner's terms, this ability also may be related to the "enactive" mode of thought. When the infant is about 6 months old, synaptogenesis also begins to increase between the limbic system, which contains the autonomic and emotion centers, and the frontal lobe of the cortex, which involves higher thinking processes. Although young infants have many emotional reactions, their ability to understand and label these emotions is not well developed until the synaptic connections between the limbic system and the cortex increase. When these connections are more strongly established during the toddler and preschool years, children can begin to use "iconic" and "symbolic" levels of thought.

Childhood Brain Maturation

The toddler years are a time of great brain activity because synaptogenesis expansion is greatest at that time, and by age 3 the child's brain has about 1,000 trillion connections, which is twice the density of the adult brain (Shore, 1997). The toddler brain is about two and a half times as active as the adult brain because it is not as efficient as the adult brain. The weight of the brain continues to increase due to the rapid expansion of synapses and the myelination of the axons and by the age of 6, the child's brain has about 90% of its adult weight. Synaptogenesis in the frontal lobe is most prominent during the latter part of early childhood, and the frontal lobe has the greatest synaptic density at about age 7. Because pruning of each area begins when synaptic density reaches its highest point, pruning in the frontal lobe begins in earnest in middle and later childhood. Pruning results in greater efficiency and thus, from age 3 to 8, children's speed of processing, memory activity, and problem-solving skills are increasing. The P300 wave, which is related to attention, problem-solving abilities, and speed of processing, begins to be observed at about age 7 (Eliot, 1999). Thus, less brain energy (glucose) is burned as the brain becomes more efficient (Haier, 1993). During this 3–8 age period individualization of the brain also becomes more evident as the structures and functions interact with environmental experiences. According to Eliot (1999), "once a given brain region has passed the refinement stage, its critical period has ended, and the opportunity to rewire it is significantly limited" (p. 38).

During the later elementary age period (8–12), the brain continues to mature, especially in the frontal lobe areas. For example, the dorso-lateral prefrontal cortex, which is involved in monitoring executive functioning skills, is made more efficient through pruning nonessential neural connections (Bauer et al., 2010). The neural circuits that an individual has used less frequently are the ones most likely to be pruned and, although such pruning increases speed of processing, the pruning also results in less flexibility to restructure brain areas. This process of individualization of brain structures is often apparent in the narrowing of activity and learning choices that children make in late elementary and middle childhood (Bergen & Coscia, 2001). During this period the brain increases its ability to use "iconic" and "symbolic" methods of representing thought.

Adolescent Brain Maturation

Recent research on the adolescent brain has discovered how much more brain maturation is still occurring during the years from 12 to 20. During middle childhood (12–14) young adolescents still use a larger area of the brain than adults do to carry out discrimination tasks because the maturation of the frontal lobe is still occurring. Myelination continues, glucose use declines, and pruning is extensive. By middle childhood, there is evidence of stable brain differences; however, areas related to executive functioning are still not mature. Research comparing adolescent and adult parietal, temporal, and occipital areas of the brain show that they are relatively similar, which indicates that those brain areas have reached a relatively mature state. In contrast, adolescent frontal lobes, which are the site of executive functioning skills, are not as mature as those of adults. All three of the thought systems described by Bruner (i.e., enactive, iconic, and symbolic) are well established, however. Although the adolescent has more advanced thinking and reasoning skills, there is still much development occurring and "the implication of these changes are not well established" (Bronk, 2010, p. 49). During adolescence another area of the brain is still maturing. That is the limbic system, which is involved in learning, memory, and emotions. For example, the adolescent brain shows continuing maturation of the amygdala, which perceives and interprets emotions; the insula, which is involved in emotions and risk-taking decisions and behaviors; and the hippocampus, which is involved in emotional, learning, and memory reactivity (Baird et al., 1999).

Longitudinal studies of brain development from childhood to adulthood show that the volume of gray matter (involved in synaptogenesis and pruning) increases and decreases in various areas of the brain in relation to the maturation of those areas, but that the volume of white matter (the myelin coatings) continues to increase until the third decade of life (Giedd & Rapoport, 2010). These researchers noted that female brains appear to reach peak periods of maturation slightly earlier than male brains, and hormonal changes in males and females also have been shown to affect brain functioning, especially in the limbic and frontal lobe areas. In a comparison of 12–16 year olds and 23–30 year olds, Sowell et al. (1999) concluded that the reported reduction in gray matter (connective tissue) occurring between adolescence and adulthood was a reflection of myelination that still was continuing after the teen years in peripheral regions of the cortex, which improved cognitive functioning into adulthood. Because brain maturation is a long process that is not fully completed until early adulthood, the play experiences of adolescents continue to be an important influence.

Play Development in the Child and Adolescent Years

According to theorists and researchers who have studied how play develops, the most common type of play seen in infancy, usually called *practice* play, involves repeating activities with increasing elaboration or difficulty and this type of play is very evident in the first year of life. Typically, infants and young children first will try to see what a particular object does when they interact with it, but soon they begin to play with the object; that is, they try to find many ways to interact with the object. As Hutt (1971) states, first children find out what an object does and then they explore what they can do with the object. She calls the first activity "exploration" and the second "play." Practice play is one way that Bruner's "enactive" mode of cognition is demonstrated. Social practice play also occurs in infant interaction with parents, siblings, and other individuals in a kind of "turn-taking" model. A good example of this is the "peek-a-boo" play routine that engages child and adult, and, although initially initiated by the adult, it is quickly taken over by the child, who controls the "peeks," with increasingly great laughter. Repetition with elaboration occurs not only with people and objects but also with language and musical sounds, and provides increasingly child-controlled playful interactions.

By the end of the first year of life, usually with an initial demonstration by adult or older child, *pretense* begins. Young children begin to act "as if" in their play by pretending that objects have social meanings and engaging in short social scripts. For example, "drinking" milk from an empty cup, "feeding" a doll with imaginary food, or "talking" on the phone are often the first evidences of such pretense. In relation to Bruner's cognitive schema, being able to treat appropriately a replica object as a real object (e.g., use driving motions with a plastic or wooden "car" or hugging a doll "baby") is an early example of the "iconic" mode of cognition. In pretense the "play frame" (Bateson, 1956) is understood even by young children and they begin to demonstrate their ability to respond to a language label or action demonstration that shows the symbolic meaning given to the objects used in the play. When the language label itself prompts a particular action, for example, acting the role of "mommy" or "doctor," in Bruner's terms, they are now able to demonstrate a "symbolic" mode of cognition. Pretense becomes increasingly elaborated over the next 5 years, and it is often observed as the major play mode of children during the toddler and preschool years. Elaborated pretense involves child-controlled scripts, roles, and scenes, both reality and fantasy based. Children use whatever experiential material is available, drawing on their life experiences or from books, television, and other media. Vygotsky (1967) has explained how the elaborated scripts that are used in pretense challenge children to act in roles that require varied social skills that may be above their present level of development and thus such pretense promotes both cognitive and social development.

In the elementary-age period, pretense continues to be a major play mode but is not as obvious to observers since it often involves small-scale dolls or action figures, elaborated but private settings, and detailed scripts that may take many days to be played out. In studies of adults' memories of their childhood play, adults often report examples of this type of pretense, which involves constructing the design of the "set" in which the pretense will occur (Bergen, 2009). Such "small-worlds" play has been reported by many McArthur Fellows as a major play mode of their youth (Root-Bernstein & Root-Bernstein, 2006). This set building is a mature form of *construction*, which involves play with building materials such as blocks and replica small-scale objects (e g., toy animals, figures, trucks). This type of play becomes prominent during the preschool age period. The difference between such construction play and actual construction is that the playfulness in the act of constructing is important (Forman, 2006). In contrast to construction that is made to last, in playful construction the designs change constantly and, once built, these constructions are as easily destroyed by the children in order to build another different world with the same materials. Children experiment with objects and other materials to learn more about the laws that operate in the physical world, and their constructions have dynamic system qualities. Pretense is often combined with construction play; that is, the "set" is designed in which the pretense occurs.

According to Piaget, the ability to play *games-with-rules* requires other sets of skills that involve social, cognitive, and moral decision making. Usually older toddlers can play one-rule games such as peek-a-boo or hide and find, but the elaboration period for games with rules begins in later preschool and becomes a major type of play during the elementary-age years. Most early games have only one or two rules and these rules can change often, depending on the players' skills and interests. Games with rules are evident in board games and in the type of outdoor games of the "child culture" that have been cataloged by researchers (Opie & Opie, 1969). The difference between such games and activities called "sports" is that games with rules are controlled by children and involve adapting or changing rules in collaboration with other children in order to make the game more "fair" or more "fun." The types of board games that are usually played by children or families are also similar to games with rules because often the rules are adapted for younger children. For example, they might get extra turns or the goal of the game may not be to win but for all to finish together.

Play as a Venue for the Development of Social, Emotional, Moral, and Cognitive Abilities

In addition to Bruner, Piaget, and Vygotsky, there are many other theorists and researchers who have discussed the potential relationships among various types of