THE MOST EDUCABLE OF ANIMALS

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There are many features that make humans different from other animals, but perhaps our most distinctive one is our ability to learn. We are the most educable of animals, and have been, I imagine, since the first members of the Homo genus roamed Africa. Humans are not the only behaviorally and cognitively plastic animal, of course, but we are better at learning “new things” and passing this knowledge on to others than any other animal, the consequence of a cognitive system that allows the explicit (i.e., self-aware) representation of information, which may be unique to Homo sapiens.

Learning “new” things—facts, procedures, and theories—is an everyday occurrence for our children, and surely was for our forechildren. In traditional societies, and certainly for all but the briefest of our species’ existence, this learning occurred via “hands on” experience in the contexts in which the skill, once acquired, would be used (Rogoff, 1998; Rogoff, Mistry, Göncü, & Mosier, 1993). Language often accompanies such informal instruction, but children learn by watching and by doing, often incorporating aspects of adult work in their play (e.g., Bock & Johnson, 2005; Lancy, 1996). Children in contemporary societies con-
tinue to do this, but modern culture has become increasingly complex, making it impossible for children to master all the skills “in context” they need in order to succeed.

As Geary makes clear, the requirement of out-of-context, or context-independent, learning makes formal schooling an evolutionarily novel and “unnatural” experience (Bjorklund & Bering, 2002). Children did not evolve to sit quietly at desks in age-segregated classrooms being instructed by unrelated and unfamiliar adults. Yet such procedures, to varying degrees, are necessary. They are necessary because the demands of modern culture require that children master basic technological skills, the most important of which are reading, writing, and mathematics, as well as knowledge in a broad realm of domains, including history, government, music, art, and the physical, natural, and behavioral sciences, among others. Not all children will master all topics of course, and one can still be a “success” in a strictly Darwinian sense by achieving only a moderate degree of literacy and numeracy. However, “success” in developed countries includes more than becoming a parent and grandparent (i.e., inclusive fitness), but attaining an economic level that permits enhanced creature comforts and a longer and healthier life. As Geary points out, this is also true at the societal level. Countries that fail to educate their children for success in an information-age society risk losing jobs to other nations with a better-educated and prepared populace (see Friedman, 2005). Given what is at stake, educating our children has never been so important and, because of our escalating ability to generate knowledge, it may never have been so complicated.

**FOUNDATIONS OF CHILDREN’S LEARNING**

Geary’s proposal is that we can best educate children if we have a solid understanding of the evolved nature of their cognition. Natural selection has provided people with intellectual and motivational systems that permit them to acquire the necessary skills and knowledge of their culture and to pass some of that knowledge on to subsequent generations. By understanding children’s inherent dispositions and motivations and how evolved cognitive abilities develop, we can better create curricula and educational systems to foster learning. Moreover, and perhaps somewhat ironically, some of our evolved cognitive and motivational biases may actually interfere with formal schooling and the learning of context-independent information. Having an understanding of both how to take advantage of evolved abilities and how to circumvent other evolved biases that may make some types of modern learning more difficult, is the task of the new field of evolutionary educational psychology.
This goal is a worthy one, but one that will not be achieved easily. First, Geary argues that placing the field of education on a more scientific foundation will reduce the conflict among competing educational approaches, and that “evolutionary developmental psychology and accompanying insights into children’s cognitive development and motivational biases will provide the first level of this foundation” (p. 76). I am in full agreement with this sentiment, but I believe that we may be years away before such a foundation is agreed upon. Evolutionary approaches to psychology have gained in acceptance over the past 2 decades, and this includes developmental psychology, thanks in no small part to Geary’s own efforts (e.g., Bjorklund & Pellegrini, 2002; Bugental, 2000; Ellis & Bjorklund, 2005; Geary, 1995, 1998; Geary & Bjorklund, 2000; MacDonald & Hershberger, 2005). However, evolutionary developmental psychologists are a minority in their discipline, and there are some who are openly hostile to such an approach, arguing that an evolutionary analysis of ontogeny as advocated by Geary (and myself) is wrongheaded (e.g., Lickliter & Honeycutt, 2003). One task of evolutionarily-oriented psychologists is to convince our colleagues that evolutionary psychology, especially when applied to ontogeny, does not represent a philosophically extreme position, but rather one that can be incorporated easily with mainstream issues in developmental and educational psychology.

Second, assuming that developmental and educational psychologists can agree on the evolutionarily-developmental foundations of cognition and learning, this will in itself not bring an end to conflict. Although perhaps seeming so to an outsider, evolutionary psychology is not monolithic. This is also true for developmental psychologists who have embraced evolutionary theory, and it will be true of educational psychologists who adopt such an approach. Although Darwin’s ideas of evolution by natural selection and the continuity of form and function from a common ancestor may be shared by all evolutionarily-minded scientists, there can be considerable debate about the specifics of evolution, both among biologists concerned mainly with evolution of structure (e.g., Gould, 2002) and biologists and psychologists concerned mainly with the evolution of cognition and behavior (e.g., Tooby & Cosmides, 2005; West-Eberhart, 2003). Moreover, even if psychologists and educators are in basic agreement about the evolved foundations for education, there will be different emphases and opinions on how to best apply this enlightened perspective, as well as differences in what constitutes educational success. For instance, in the last pages of the monograph, Geary makes a proposal for paying special attention to the education of intellectually gifted children—that the best and the brightest should not be hampered by focusing on educational practices that benefit the masses. I agree with Geary on this, but others will not, and I can imagine other issues related to the
societal “purpose” of education on which he and I may disagree. None-
theless, should the field of developmental or educational psychology be
fortunate enough to share a common belief on the foundational issues,
disagreements and conflicts should be more easily resolved, hopefully
through the evaluation of empirical research testing hypotheses derived
from evolutionary developmental theory.

**THE ADAPTIVE NATURE OF COGNITIVE IMMATURITY
AND EDUCATING YOUNG CHILDREN**

One perspective from evolutionary developmental psychology that is per-
tinent to educational psychology, I believe, is the idea that aspects of chil-
dren’s immature cognition are sometimes adaptive—well-suited to the
niche of childhood in which they find themselves, even if, initially, they
make learning culturally important information or skills more difficult
(Bjorklund, 1997; Bjorklund & Green, 1992; Bjorklund & Pellegrini,
2002). In other words, some aspects of developmental immaturity are not
simply the inevitable byproduct of an extended juvenile period that must
be overcome so that children can acquire the important technological
skills that will determine their success or failure in the adult world; rather,
from an evolutionary developmental perspective, they represent naturally
selected, age-related, intuitive biases that serve to “prepare” children for
making sense of species-typical experiences at different times in ontog-
eny. Some aspects of immaturity may influence how children evaluate or
process information, such as a bias for relating new information to oneself
(e.g., Piaget & Inhelder, 1969) or processing literal versus “gist” aspects of
stimuli (e.g., Brainerd & Reyna, 1990), or for overestimating one’s intel-
lectual abilities and task performance (e.g., Stipek, 1984). Others may
affect children’s interests or the contexts in which they prefer to engage,
such as a preference for rough-and-tumble play, especially for boys (Pelle-
grini & Smith, 1998), interest in caring for babies, especially for girls
(Maestripieri & Rooney, 2006), or an orientation toward dominance rela-
tions (Hawley, 1999). These biases may involve evolved mechanisms that
serve to adapt children to specific times in ontogeny, referred to as *ontoge-
netic adaptations* (Oppenheim, 1973), or they may serve instead (or more
likely in addition) to prepare children for life as adults, referred to as *deferred adaptations* (Hernández Blasi & Bjorklund, 2003). These evolved
biases change over time, and educators must keep such developmental
differences in mind when creating curricula.

The use of direct instruction in young children is a case in point. For
example, Geary notes emphatically that: “The gist is that the cognitive and
motivational complexities of the processes involved in the generation of secondary
knowledge and the ever widening gap between this knowledge and folk knowledge leads me to conclude that most children will not be sufficiently motivated nor cognitively able to learn all of secondary knowledge needed for functioning in modern societies without well organized, explicit and direct teacher instruction” (p. 43, italics in the original). This is a warning to educators who insist that true learning is only achieved via a process of discovery, and who hold, much as Piaget (1972) did, that “less is more” when it comes to teacher-directed instruction. (“It is despite adult authority, and not because of it, that the child learns. And also it is to the extent that the intelligent teacher has known to efface him or herself, to become an equal and not a superior, to discuss and to examine, rather than to agree and constrain morally, that the traditional school has been able to render service” [Piaget, 1977, cited in Rogoff, 1998, p. 38]). I am in basic agreement with Geary on this point, although I fear that some educators will read this as meaning that nearly all instruction for children of any age should be teacher directed, and this is not a position that I believe is consistent with what we know about children’s developing cognitive systems from an evolutionary perspective.

Particularly in the United States, there have been efforts to introduce formal education to the crib, and even the uterus, based on the seemingly remarkable perceptual and cognitive abilities of infants (see Spelke & Newport, 1998; Stone, Smith, & Murphy, 1973). Research has shown that newborns can learn to recognize stories their mothers had read during the last months of pregnancy (e.g., DeCasper & Spence, 1986); newborns can match facial expressions of adult models (e.g., Meltzoff & Moore, 1977); and infants within the first 6 months of life appear to have some quantitative abilities, such as recognizing the addition and subtraction of small quantities of objects (e.g., Wynn, 1992) or understanding many of the physical properties of objects (e.g., solidarity, continuity; e.g., Spelke & Newport, 1998). These are biologically primary abilities in the realms of folk psychology and folk physics, and although such abilities may one day serve as the basis for biologically secondary abilities, this does not mean that formal “instruction” should begin in the playpen, to say nothing of in the womb. Although these abilities may prepare infants for dealing with their social and physical worlds, they are not necessarily well-suited to serve as a basis for more formal instruction, at least not at this time in their lives.

Yet, parents are quick to buy books and gadgets designed to provide intellectual stimulation to infants, and even fetuses, believing that earlier is better. For example, Logan (1991) developed BabyPlus, a “fetal enrichment technology” that fits around a pregnant mother’s belly and plays sounds to her fetus. The rationale for this is that prenatal brain stimulation can prevent the usual pattern of brain-cell death that occurs before birth, increasing the number of neurons and synapses a baby has when it
first sees the world, setting the stage for better learning and greater intelligence. Yet, selective cell death during the prenatal and postnatal months is the species-typical pattern, and preventing such cell loss (if that is what BabyPlus would actually do) may have unintended consequences. According to neuroscientist Peter Huttenlocher (2002, p. 214): "One has to consider the possibility that very ambitious early enrichment and teaching programs may lead to crowding effects and to an early decrease in the size and number of brain regions that are largely unspecified and that may be necessary for creativity in the adolescent and adult." Similar arguments can be made for overly ambitious postnatal instruction. In fact, research evidence from a variety of species indicates that perceptual and learning experiences provided to young animals that exceed the species-normal range can produce maladaptive outcomes, including disruption of auditory attachment behaviors when quails are given visual experience before hatching (e.g., Lickliter, 1990) to slower rates of learning when infant rats (e.g., Rudy, Vogt, & Hyson, 1984), monkeys (e.g., Harlow, 1959), or humans (e.g., Papousek, 1977) are given learning experiences earlier than is typical (see Bjorklund, 1997; Bjorklund & Green, 1992 for more in depth discussion).

This theme of “earlier is not necessarily better” can be extended into the preschool years. Most children in the United States and Europe spend some time during these years in daycare, with varying degrees of educational enrichment. Programs in the United States have often emphasized formal instruction, preparing children for kindergarten and first grade. The argument is straightforward and logical: if education is the key to success in modern society, then beginning formal education early should provide children with an advantage. However, an alternative perspective, consistent, I believe, with what we know about children’s developing cognition from an evolutionary perspective, is that the thinking of preschool children is, in many (but not all) ways, qualitatively different from that of older children, and is well-suited to understanding their surroundings, and that learning is best achieved in more “playful” and “natural” settings (Bjorklund, 1997; Bjorklund & Green, 1992).

Most educators, psychologists, and social policymakers today recognize the need for daycare for preschool children and acknowledge that “quality daycare” is not only not harmful for children but can be intellectually beneficial (e.g., Lamb & Ahnert, 2006). Quality daycare often involves an educationally relevant curriculum, designed to provide young students with intellectually stimulating activities. The question then arises, if one is going to educate preschoolers, how does one do it? Should 3- and 4-year olds receive formal instruction in the important technological skills of reading and arithmetic, much as is provided for early school-age children (referred to as direct-instructional programs)? Or should the curriculum be
geared to children’s “natural” propensities (referred to as developmentally appropriate programs)? I do not believe that there is an obvious answer to this based on Geary’s proposals. For example, one could argue that adults should take advantage of children’s inherent motivation to acquire basic knowledge in the realms of folk psychology, biology, and physics, which could best be done in developmentally appropriate programs. The argument could also be made that children’s intuitive notions in these areas interfere with learning of important technological skills, and formal instruction is required so as not to make subsequent learning even more difficult.

Research examining the effects of developmentally appropriate versus direct-instructional preschools programs has produced mixed results. Some studies report superior number and prereading skills at the end of the school year for children in developmentally appropriate programs (e.g., Stipek, Feiler, Blyer, Ryan, Milburn, & Salmon, 1998); others find better performance on some academic measures for children in direct-instructional programs (e.g., Stipek, Feiler, Daniels, & Milburn, 1995); and still others find no appreciable differences (e.g., Hirsh-Pasek, Hyson, & Rescorla, 1990). More studies have found long-term (1 year or longer) benefits associated with developmentally appropriate programs relative to direct-instructions programs (e.g., Burts et al., 1993; Marcon, 1999). For example, Marcon (1999) followed children for 6 years who had attended either a developmentally appropriate or direct-instructional preschool and reported that although there was no difference in academic performance between the two groups of children by the end of third grade, by the end of fourth grade children who had the developmentally appropriate preschool curriculum had higher grades than those who had attended the direct-instructional programs.

The difference between developmentally appropriate and direct-instructional programs is clearer when motivational and psychosocial factors are considered. Most studies have found that children attending developmentally appropriate programs experience less stress, like school better, are more creative, and have less test anxiety than children attending direct-instructional programs (Burts et al., 1993; Hirsh-Pasek et al., 1990; Schweinhart & Weikart, 1988; Stipek et al., 1995, 1998). For example, in a study by Stipek and her colleagues (1995), preschool and kindergarten children from a range of households attended either developmentally appropriate or direct-instructional programs. Although children who attended direct-instructional programs demonstrated greater knowledge of letters and reading achievement than children attending developmentally appropriate programs, no differences were found on knowledge of numbers, and children in the developmentally appropriate programs rated themselves as having greater intellectual
abilities, were less dependent on adults for permission and approval, expressed greater pride in accomplishment, had higher expectations for success on school-like tasks, chose more challenging math problems to perform, and said they worried less about school than children in the direct-instructional programs. In other words, any academic benefits gained from a teacher-directed program had its costs in terms of motivation.

My conclusion from reviewing this admittedly limited literature is that, overall, preschool children who attend developmentally appropriate programs fare better than children who attend direct-instructional programs. I interpret this as being consistent with an evolutionary developmental perspective that emphasizes taking advantage of the intuitive learning biases of young children when constructing educational curricula. This is not an argument against direct instruction, some of which surely takes place in even the most “developmentally appropriate” of programs. Direct instruction is a crucial mechanism for transmitting cultural knowledge, and it seems obvious that it should be a key instrument in all teachers’ toolkits. It is only when direct instruction replaces more child-centered learning for young children that problems potentially arise.

David Geary’s call for an evolutionary educational psychology is timely and one I hope will be heard and heeded by a wide audience. His proposal to base education on a more serious, scientific basis is not new, of course, but one that has been made by most generations of educational psychologists. The novelty of Geary’s approach is to base educational practices not only on science that examines proximal causes of behavior, but also on science that explores its distal causes. An evolutionary perspective on development and education, particularly when combined with traditional psychological investigations and advances in neuroscience, can provide insights that may revolutionize how culturally important information is transmitted across generations.

REFERENCES


