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A Disconnect Between Law and Neuroscience: Modern Brain Science, Media Influences, and Juvenile Justice

Kevin W. Saunders*

Constitutional law is often a matter of analyzing history and underlying legal principles or philosophical concepts such as equality and human dignity, but there are instances in which facts play a strong to dispositive role. If government infringes on a fundamental right, its action is evaluated using a strict scrutiny test; the infringement must be necessary to a compelling governmental interest. But the assessment of whether a governmental interest is compelling cannot be made in the abstract. Interests are compelling or not depending on the circumstances, and the descriptions of those circumstances are statements about facts. If the interest is found to be compelling, whether the statute or other action is necessary to that interest also turns on the facts of the situation.

Courts have regularly said that the state has a compelling governmental interest in the physical and psychological well-being of youth. For example, in Video Software Dealers Ass'n v. Webster, one of the earlier cases addressing concerns over the exposure of youth to media violence, the court recognized that interest as compelling, but still declared unconstitutional a statute limiting the distribution to minors of violent videos. The court based its conclusion on concerns over the facts that could be demonstrated; even if there is some connection of media violence to real world violence, the court could not determine just what sort of violent depiction caused that effect.

In more recent cases, courts have been more general in their refusal to see any causative effect. Those cases may have required a more general rejection because the ordinances at issue were more specific, aiming not at violent film or violent media generally, but at the sort of violent video game in which the player takes an active role. If any violent media are to have a causative effect in real world violence, these “first-person shooter” games would appear most likely. Yet

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2 Id. at 1283.
3 Id. at 1281.
4 Id.
5 See infra Part II.B.2 (discussing research on effect of violent video games on real world
in *American Amusement Machine Ass’n v. Kendrick*, the Seventh Circuit rejected a limit on youth play in arcades. The court seemed to accept the compelling interest in the health and well being of youth, but went on to reject the social science regarding causation, saying “[t]he studies do not find that video games have ever caused anyone to commit a violent act, as opposed to feeling aggressive, or have caused the average level of violence to increase anywhere.”

For good measure, the court added: “Common sense says that the city’s claim of harm to its citizens from these games is implausible, at best wildly speculative.” Likewise, in *Interactive Digital Software Ass’n v. St. Louis County*, the Eighth Circuit clearly accepted the county’s claim of a compelling interest in the psychological health of children. Once again, however, the court rejected the social science claims that violent video game play has a negative impact on that interest.

The debate over whether the state can limit the access of children to violent video games has been primarily factual. While the cases turn on First Amendment issues, the application of the amendment largely has depended on whether playing these games causes harm to children. Courts have been unable to see the relationship that most social scientists and health care professionals take as established. Some of this refusal may be because whatever causation there is, is not consistent and universal; that is, even if violent video game play causes real world violence, not all who play such games become violent. That is certainly true, just as it is true that not all who smoke cigarettes eventually suffer from lung cancer. The acceptance of tort liability on this sort of statistical causation was a drawn out and difficult process. It can only be more difficult where a constitutional right rides on the probabilistic connection. An additional difficulty in accepting causation in the case of violent video games is that mental processes seem somehow more mysterious than the physical cause and effect relationship between smoke and lung cancer.

There may be skepticism as to the likelihood that experiences such as violent video game play can affect the aggressiveness, morality, and judgmental capacity

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6 244 F.3d 572 (7th Cir. 2001).
7 Id. at 580.
8 See id. at 576.
9 Id. at 578–79.
10 Id. at 579.
11 329 F.3d 954 (8th Cir. 2003).
12 Id. at 958.
13 See id. at 958–59.
14 See infra Part II.B.2 (discussing research on effect of violent video games on real world aggressiveness and violence).
of a teenager. It is here that the new developments in neuroscience can have an impact. Neuroscience now recognizes that our earlier view—that physical development of the brain is complete in early childhood—is incorrect; that the portions of the brain responsible for judgment and inhibition develop at a later stage. It thus becomes clearer how experiences in that later developmental stage could have an impact on the outcome.

It is perhaps clearer how facts and factual disputes affect policy issues. The process of legislation involves creating law to address a perceived problem. While labeling a situation a problem involves value issues, there must be a factual background against which that judgment is made. There is also a factual component in developing the solution proposed to the problem. Where a fundamental right is not infringed, a statute or policy need not meet strict scrutiny, but there still must be a rational connection between the interest addressed and the solution implemented by the law. Whether such a connection exists is a factual issue.

The policy issue to be addressed here—a policy issue spoken to strongly by new information on brain development—is juvenile justice. If there is no real difference between juveniles and adults, it makes sense to subject juvenile offenders to trial in the adult criminal courts. It also makes sense, once convicted, to punish those offenders with the same severity as adults convicted of the same offense. To the degree that juveniles differ from adults, the reasonableness of similar treatment diminishes. If children are not just miniature adults but are truly different, the justice system should treat them differently.

Newly developing neuroscience shows that children differ from adults in ways that are important to criminal justice. If the portions of a child’s brain that are involved in morality, judgment, and inhibition of impulses are simply not developed, it is more difficult to attribute moral fault to a child in the same way it may be attributed to an adult. While society may need to protect itself from a particular child, a focus on rehabilitation coupled with incapacitation is called for. The retribution behind some uses of adult punishment seems inappropriate if a child is too young to be capable of the moral reasoning and self-control expected of adults.

This Article will begin with an examination of moral development in children. It will examine earlier psychological theories, and will show that even those theories have come to recognize an extended period of development. Then, it will present new discoveries of brain development in later childhood and adolescence. It will then apply the new understanding of brain development to concerns over media influence and argue that children need to be protected from influences that can lead their moral development astray. The Article then turns to the issue of juvenile justice and argues that these new understandings of the

16 See infra Part I.B (discussing neuroscience contributions to study of moral development).
17 See infra Part I.A (discussing nonneuroscience-based developmental theory).
18 See infra Part I.B (discussing neuroscience contributions to study of moral development).
19 See infra Part II (addressing shielding youth from negative media influences).
developing brain lead to the conclusion that children should not be subject to the same sorts of punishment that may be appropriate for adult offenders.\textsuperscript{20}

I. THE ADOLESCENT BRAIN AND THE DEVELOPMENT OF JUDGMENT AND MORALITY

A. Nonneuroscience-Based Developmental Theory

There are a variety of nonneuroscience approaches or schools of thought on the development of moral reasoning in children. In the context of this discussion, "nonneuroscience approaches" means those approaches based not on the physical structure of the brain, but on studying growth in the moral and judgmental sphere through examination of the behavior and responses of children of various ages. The nonneuroscience approaches show a growing recognition of the long-term process that constitutes moral development, which parallels neuroscience's recognition of the fact that teenagers are not fully developed morally but are still very much moral agents under construction.

Psychologists have studied the development of children for some time and have clearly recognized that it is a process that takes time; how much time depends on the sort of theory or perspective employed.\textsuperscript{21} Early work on the issue took the form of psychodynamic theories that stressed affective features and saw moral development as growing out of the child's emotional attachment to his or her parents and the influence that parents have on the moral standards children adopt as their own.\textsuperscript{22} In Freud's theory, the moral development of boys is part of the phallic stage and the resolution of the Oedipal complex, where a boy suppresses his instinctual urge towards his mother and allies with his father.\textsuperscript{23} That alliance includes adopting the moral values of the father. Freud saw the resolution of the analogous Electra complex in girls as less traumatic and leading to a weaker moral sense.\textsuperscript{24} Despite what would now be seen as a sexist conclusion, the theory established a process of moral development for all children. For Freud, however, this process occurs relatively early in the child's development, through the age of five or six, and would seem complete with the resolution of the Oedipus or Electra Complex.\textsuperscript{25}

Social learning theories emphasize the acquisition of learned moral behavior.\textsuperscript{26} Under these theories, children learn morality by being rewarded or

\textsuperscript{20}See infra Part III (addressing juvenile justice).

\textsuperscript{21}A general discussion of the moral development of youth may be found in any number of introductory psychology or human development texts. See, e.g., DANUTA BUKATKO & MARVIN W. DAEHLER, CHILD DEVELOPMENT: A TOPICAL APPROACH 535-73 (1992).

\textsuperscript{22}Id. at 536.

\textsuperscript{23}Id.

\textsuperscript{24}Id. at 536-37.

\textsuperscript{25}Id. at 537.

\textsuperscript{26}Id. at 536.
punished for their behavior. They also learn by observing behavior in others and the reactions that that behavior elicits. They model their conduct after the behavior of others. “Children who observe a model committing a prohibited act, such as touching a forbidden toy, are more likely to perform the act themselves, whereas children observing a model who resists temptation commit fewer transgressions themselves.”

Under these theories, moral behavior is learned like other behaviors and skills and results in increasing conformity with standards expected by society. Accordingly, these theories would seem to contemplate a somewhat more extended period during which morality develops.

Another variety of moral development theories makes clearer the extended time period required for moral development. Such “cognitive-developmental theories” focus on the child’s developing ability to reason morally, the ability to think about moral problems and to make moral decisions. Jean Piaget contributed the important early work taking this approach. Piaget examined the moral development of children by presenting a variety of stories to children at different ages, asking questions about the stories, and studying the children’s responses. In each story, a person does something that causes a harm, but the stories vary in the seriousness of the harm done and in the intention of the actor causing the harm. Piaget found that children younger than ten years old focus on consequences. For that age group, it is not the intention of the actor that is the measure of wrongfulness or fault; rather, how much harm occurs determines how wrong the act was. It is only with older children that motives and intentions come to play a role in determining fault. There is sense in considering this a cognitive development, since a focus on intent can only come about after the child develops an ability to understand motives and intentions. An ability to understand the mental states of others requires experience with other people, and this understanding implies a cognitive aspect.

It is clear from Piaget’s work that there is an lengthy period during which moral development takes place, extending well beyond the early cognitive development that occurs in infancy. More recent work by Lawrence Kohlberg shows that this moral development continues on through the teenage years and even into early adulthood. Kohlberg employed Piaget’s strategy in presenting

27 Id. at 539 (citing L.I. Rosenkoetter, Resistance to Temptation: Inhibitory and Disinhibitory Effects of Models, 8 DEVELOPMENTAL PSYCHOL. 80, 80–84 (1973)).
28 Id. at 537–38.
29 Id. at 536.
31 BUKATKO & DAEHLER, supra note 21, at 541.
32 Id.
33 Id. at 541–42.
34 Id.
35 Id.
36 For a discussion of the cognitive development that occurs in infancy, see infra Part I.B.1.
37 See 2 LAWRENCE KOHLBERG, Moral Stages and Moralization: The Cognitive-Developmental
children and young adults of various ages with situations that raise moral questions. For example, Kohlberg asked about a man whose wife was dying of cancer. A local pharmacist had developed a new drug that could save her, but the pharmacist was charging far more than the husband could afford, a price that was also far greater than the cost of manufacturing the drug. The man tried to get the pharmacist to reduce the price or to provide the drug on the promise to pay at a later time, but the pharmacist had refused to make any concession. Faced with the inability to obtain this vital drug, the man broke into the pharmacy and took it.

When Kohlberg asked the children if the husband should have stolen the drug, he found differences in moral development in children beyond the age of ten. His original study involved ten- to-sixteen-year olds; children at different ages in that growth span responded differently. Not all children of the same age were at the same stage of moral development, but they did progress through moral stages, even if the rate of progress varied. Kohlberg’s interest was not in the yes-or-no response to the question of whether the man should have taken the drug—certainly a complex question—but with the moral reasoning that the children used to support their positions.

Kohlberg found that children progress from what he called the “preconventional stage” to the “conventional” and “postconventional” stages of moral reasoning, with each stage having two substages. At the preconventional stage, or what he called in his dissertation the “premoral” stage, the children focused on punishment and reward. In the first of the two substages, the “punishment and obedience orientation,” or “heteronomous morality” substage, the children were concerned with not breaking rules in order to avoid...
punishment. As Piaget had found, children ignored motive and focused solely on the consequences of the act.

In the second substage—"naive instrumental hedonism" or "individualism, instrumental purpose, and exchange"—children focused on following rules when it was in their interest. This included being rewarded, and a recognition that there is more involved in moral judgement than simply considering the magnitude of the consequences of an act.

Children at the conventional level recognize that there are societal rules and a social order. At that stage, the intentions, motives, and perspectives of others play a role in moral reasoning. In the first substage—the "good-boy morality" or "mutual interpersonal expectations, relationships, and interpersonal conformity" substage—the child's focus is on avoiding disapproval. This is a step beyond simply avoiding punishment and living up to what is expected of the child; here, motives become important. At the second "authority-maintaining morality" or "social system and conscience" substage, the stress shifts to adhering to rules, and accepting and fulfilling duties within the context of the social system. Kohlberg saw this fourth substage as going beyond the developmental stages that Piaget had set out, thus the remaining stages of Kohlberg's work extend the process and length of the period of development.

Some children may reach what Kohlberg called the "postconventional, or principled" stage, but this stage is more likely reached as a young adult. There, the individual has developed an understanding of the nature of laws and rules.

They are now seen as the result of a social contract that all individuals must uphold because of shared responsibilities and duties. The individual recognizes the relative and sometimes arbitrary nature of

\[\text{\textsuperscript{51}id.}\]
\[\text{\textsuperscript{52}See Kohlberg, Stage and Sequence, supra note 37, at 49.}\]
\[\text{\textsuperscript{53}See KOHLBERG, supra note 37, at xxix.}\]
\[\text{\textsuperscript{54}See id. at 174.}\]
\[\text{\textsuperscript{55}See id.}\]
\[\text{\textsuperscript{56}See Kohlberg, Stage and Sequence, supra note 37, at 49.}\]
\[\text{\textsuperscript{57}See KOHLBERG, supra note 37, at xxix.}\]
\[\text{\textsuperscript{58}See id. at 174.}\]
\[\text{\textsuperscript{59}See id.}\]
\[\text{\textsuperscript{60}See id. at xxix.}\]
\[\text{\textsuperscript{61}See id. at 175.}\]
\[\text{\textsuperscript{62}See id.}\]
\[\text{\textsuperscript{63}See id. at xxviii.}\]
\[\text{\textsuperscript{64}See id. at 175.}\]
\[\text{\textsuperscript{65}In Kohlberg's later work, he said that the fifth substage—the first postconventional substage—would appear in the post-college years rather than in adolescence. \textit{id.} at 5. He further noted that the sixth substage was more of a theoretical ideal, \textit{id.}, and that in applying a refinement of the standards, none of the individuals studied, with one possible exception, had attained that level. See Lawrence Kohlberg et al., \textit{The Current Formulation of the Theory}, in KOHLBERG, supra note 37, at 212.}\]
rules, which may vary from group to group. Certain principles and values, however, such as justice and human dignity, must be preserved at all costs. 66

Again there are two substages. In the first substage—the "morality of contract, of individual rights and democratically accepted law" 67 or "social contract or utility and individual rights" substage 68 —there is an awareness that rules and values are the product of the social group, that obligation to obey the rules is a matter of acceptance of a contract among individuals to be governed by laws aimed at accomplishing the greatest good, and that the rules may sometimes conflict with the demands of morality. 69 In the second substage, the "morality of individual principles of conscience" 70 or "universal ethical principles" 71 substage, the individual recognizes universalized principles that should govern conduct and that, if the principles are in conflict with the law, it is the principles that should be followed. 72 This second substage of the post-conventionalist stage is one that few if any reach, even as adults. 73

Again, the cognitive aspects of development are clear. The child's experiences and observation of others, both in their acts and responses to the acts of others, play a role in the child's developing ability to reason about moral issues. In learning to reason about how to act in a society, how violations are punished, how rules come to be, and how to understand themselves in the context of society, children (and adults) will learn from their interactions with others.

It is important to note, before leaving the cognitive development theories, that Kohlberg's work has been criticized. Carol Gilligan argues that Kohlberg's stages present a male-centered theory and that females may go through their moral development in a different manner. 74 Gilligan says that applying Kohlberg's analysis to the moral reasoning of women would have them mired in stage three, but that "the very traits that define the 'goodness' of women, their care for and sensitivity to the needs of others, are those that mark them as deficient in moral development." 75 She sees a "personal reconstruction of morality," as Kohlberg did in his study, but with a different focus—not a focus on rules and rights, but instead on responsibility to others. 76 Given different views of maturity in males and females, it is unsurprising that there would be differences in responses to

66 Bukatko & Daehler, supra note 21, at 545.
67 See Kohlberg, supra note 37, at xxix.
68 See id. at 175.
69 See id.
70 See id. at xxix.
71 See id. at 176.
72 See id.
73 See supra note 65 (explaining post-conventionalist substages).
75 Id. at 18.
76 Id. at 21–22.
hypotheticals such as those presented by Kohlberg, but there is still a moral growth in females toward a different endpoint. While Gilligan presents her own examination of the stages of moral development of girls, it is still clear that development takes place throughout childhood, into adolescence, and even into adulthood.77

B. Neuroscience's Recent Contribution to the Study of Moral Development

The nonneuroscience study of moral development has moved from a theory in which children reach moral maturity earlier in childhood to one in which the development process is further extended. This change in theory presages, and is in turn supported by, recent discoveries in neuroscience.78 In the not-too-distant past, the physical development of the brain was seen as complete in early childhood; more recently, researchers have discovered physical brain changes in later childhood and adolescence. The expansion of the psychological theories to recognize continued development in older children is matched by an expanded recognition of brain development. Furthermore, since these developments occur in areas of the brain particularly tied to moral development, the work of the later cognitive development theorists is backed up by the new neuroscience developments.79

77Positing stages of moral development may be seen as accepting an ethical theory that values what are seen as higher stages over lower. This hardly surprising since it is moral development. If so, the theory and study of moral development is not purely a matter of psychological science and may even be culturally relative. Nonetheless, the process through which children reach, or fail to reach, what the culture sees as "higher stages" is still a process. And the steps in that process are stages of development that younger children may not have reached.

78Much of the literature on brain development in children is somewhat opaque to the layman, consisting of cross sectional pictures of autopsied brains, with explanations of staining and counting processes, or results of magnetic resonance imaging or positron emission tomography studies. Fortunately, a secondary literature has begun to develop. The best of the secondary sources is written by Barbara Strauch, the medical science and health editor of The New York Times. See BARBARA STRAUCH, THE PRIMAL TEEN: WHAT THE NEW DISCOVERIES ABOUT THE TEENAGE BRAIN TELL US ABOUT OUR KIDS (2003). While the science is interspersed with anecdotal material that the reader may or may not find interesting, the scientific explanations are well written, sufficiently detailed, and accessible. For less detailed, popular presentations on teenage brain development, see, for example, Sharon Begley, Getting Inside a Teen Brain, NEWSWEEK, Feb. 28, 2000, at 80 (describing differences between adolescent and adult brains); Shankar Vedantam, Are Teens Just Wired that Way? Researchers Theorize Brain Changes Are Linked to Behavior, WASH. POST, June 3, 2001, at A1 (reporting that brain changes as youth mature through adolescence); Mara Rose Williams, Science Finds Neurological Clue to Teen Irresponsibility, PHILA. INQUIRER, Nov. 24, 2000, at A36 (same).

79Note that the cognitive development theories, discussed supra notes 26–76 and accompanying text, are not the full-blown theories used to analyze legal discourse and that have been recently criticized. See VINCENT DESCOMBS, THE MIND'S PROVISIONS: A CRITIQUE OF COGNITIVISM (Stephen A. Schwartz trans., 2001); STEVEN L. WINTER, A CLEARING IN THE FOREST: LAW, LIFE, AND MIND (2001); Dennis Patterson, Fashionable Nonsense, 81 TEX. L. REV. 841 (2003) (reviewing ANTHONY G. AMSTERDAM & JEROME BRUNER, MINDING THE LAW (2000)). The cognitive development on which they rest is simply the acquisition of knowledge of the world, even if
1. Earlier Views of Brain Development

Until recently, the accepted view of brain development was that it occurred early in life. By the time a person reached the teen years, the brain had completed its growth; in fact, brain growth was finished in the period of early childhood. A professor of pediatrics and neurology at the University of Chicago’s medical school conducted one of the early physical studies of human brain growth and age-related changes. In the late 1970s, Professor Huttenlocher examined the brains of twenty-one normal human beings ranging in age from newborn to ninety. Brain tissue was removed at autopsy. The study looked at the density of synapses in the middle frontal gyrus region of the frontal cortex. Synapse density was constant for adults aged sixteen to seventy-two, and showed a slight decline in old age. What was more interesting were the changes in infancy and early childhood. The synaptic density of newborns was equal to that of adults, but density increased in infancy until a point between ages one and two, at which time it reached a density fifty percent higher than that of adults. The synaptic density then declined from age two to sixteen. There was a similar growth and a similar—but later—decline in neuronal density. Neuronal density was very high in newborns but declined steeply in the first six months of life, with a more gradual decline in later infancy and childhood. As with synaptic density, neuronal density at age two was about half again that of adults, but it had already fallen by approximately a factor of ten from that of a newborn. At age seven,

perceptions differ from person to person, necessary to the accomplishment of tasks and the processing of information that underlies making judgments.

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80STRAUCH, supra note 78, at 7.
82Id. at 197.
83Id. at 195.
84Synapses are the points at which nerve cells, or neurons, communicate with each other. They are gaps between the dendrite of one neuron and the axon of another. Dendrites and axons are branching protuberances from neuron cell bodies that allow a chemical proximity among neurons whose cell bodies may be some distance apart. The axon of one neuron releases a chemical neurotransmitter into the gap that causes a reaction in the dendrite of the other. See, e.g., CHRISTOPHER PETERSON, INTRODUCTION TO PSYCHOLOGY 56–58 (1991).
85The cortex is the outer layer of the forebrain, the most highly evolved part of the brain. The frontal cortex is that part located behind the forehead. See, e.g., id. at 64–65. On the role of the frontal cortex, see infra notes 127–35 and accompanying text.
86Huttenlocher, supra note 81, at 195.
87Id.
88Id.
89Huttenlocher, supra note 81, at 195. Neurons are the cells of the nervous system. See PETERSON, supra note 84, at 56–58.
90Huttenlocher, supra note 81, at 200.
91Id.
neuronal density is about ten percent higher than in adults.92

Professor Huttenlocher considered his results to be “somewhat unexpected”93 and set about providing an explanation of human brain growth that combined the synaptic and neuronal density findings. Knowing the density of neurons and of synapses, it was possible to calculate the number of synapses per neuron. The results showed rapid growth from about 10,000 synapses per neuron at birth to 100,000 synapses per neuron by age one, with some decrease in late childhood.94 In contrast, dendrite growth and arborization95 increased considerably after age one, leading to a conclusion that synaptic density declines on the surface of dendrites, as the dendrites expand.96 Huttenlocher noted that total brain weight increased only about twenty percent from age two to maturity, that at least some of this increase was due to an increase in myelin,97 and that the brain is practically fully grown at age seven, an age at which synaptic density is still thirty-six percent higher than in the adult brain.98 He also suggested synapse loss is determined by use or nonuse. Unused or nonfunctioning synapses degenerate,99 a theory that allows for an environmental impact, as interaction with surroundings either fire or fail to fire particular synapses.

A later study led by Professor Harry Chugani used positron emission tomography (“PET”) scans to measure glucose use in the brain.100 The glucose use of newborns was less than that of adults, but climbed to adult levels by age one and to twice adult levels by age three to four; it remained steady until age nine, and declined to adult rates between ages fifteen and twenty.101 It became clear to Chugani that brain development continued into the second decade of life, a conclusion he did not consider novel—even at that time.102 Chugani’s study also found regional differences in the brain’s glucose usage at different stages.103 The evolutionarily older portions of the brain matured more quickly.104 The brain stem’s and cerebellum’s glucose usage was closer to adult level at birth and in the first year, and even within the cerebellum, the evolutionarily older portions

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92 Id.
93 Id. at 201.
94 Id. at 202.
95 Dendrites are one of the two sorts of branches of neurons or nerve cells. See Peterson, supra note 84, at 57.
96 See Huttenlocher, supra note 81, at 202.
97 Myelin is a fatty insulation covering some neurons and allowing far greater speed of transmission along those neurons. Myelin increases in infancy and explains some of the differences in motor skills between infants and older children. See Peterson, supra note 84, at 57.
98 Huttenlocher, supra note 81, at 202.
99 Id. at 203.
101 Id. at 490.
102 Id. at 496.
103 Id. at 491.
104 Id. at 490.
showed a maturational rise earlier.\textsuperscript{105} In the more advanced cerebral cortex, the highest glucose use in newborns was in the primary sensorimotor region, with the rest of the cerebral cortex displaying lower metabolic rates.\textsuperscript{106} Overall, glucose use in the cerebral cortex was less in the first year of life than in adults, but in the age range of three to eight, it grew to approximately twice that of adults.\textsuperscript{107}

By the time Professors Huttenlocher and Dabholkar published a 1997 paper on synapse development, the differences that Professor Chugani noted in various regions of the brain had been noted by others as well.\textsuperscript{108} It had been shown that maximum brain growth, branching of dendrites, and myelination occurred earliest in the primary motor and sensory regions and latest in the prefrontal cortex.\textsuperscript{109} Huttenlocher and Dabholkar, based on study of brain tissue obtained at autopsy from fetuses, children, adolescents, and adults, confirmed regional differences.\textsuperscript{110} There was rapid postnatal development of synapses in both the visual and auditory cortex, but synapse development in the prefrontal cortex was delayed.\textsuperscript{111} While synapse development in the prefrontal cortex caught up with the visual and auditory regions by age three-and-one-half, by that time, synapses in the visual cortex had already begun to be eliminated.\textsuperscript{112} The authors noted that their results matched findings that dendrites are also less developed in the prefrontal cortex than in the sensory area both at birth and at age three months; that myelination in the prefrontal cortex was incomplete at age twelve months, but myelination in other areas had reached adult levels by that age; and that there were similar differences in energy metabolism.\textsuperscript{113}

Huttenlocher and Dabholkar also drew conclusions about the role of environment from their studies. They explained that synapse development is triggered by contact between neurons and that most synaptic contacts seem to be random.\textsuperscript{114} Once the synapses develop, however, the environment plays a role in their stabilization. “Stabilization of randomly made synapses appears to be activity dependent. Synaptic contacts that are not included in neuronal circuits are gradually eliminated . . . Synapse elimination, in contrast to synaptogenesis, seems to be at least to some extent environmentally regulated.”\textsuperscript{115} They also noted that the regional differences in synapse development and elimination appear to match differences in functional development of the brain regions.\textsuperscript{116} As later

\textsuperscript{105}Id. at 491–93.
\textsuperscript{106}Id. at 490.
\textsuperscript{107}Id.
\textsuperscript{109}Id. at 167.
\textsuperscript{110}Id. at 173.
\textsuperscript{111}Id.
\textsuperscript{112}Id.
\textsuperscript{113}Id. at 175–76.
\textsuperscript{114}Id. at 176.
\textsuperscript{115}Id. at 176–77 (citations omitted).
\textsuperscript{116}Id. at 177–78.
studies would confirm, Huttenlocher and Dabholkar suggested that

[m]ore complex 'executive' functions of the prefrontal cortex such as reasoning, motivation, and judgment appear to develop gradually during childhood and adolescence, perhaps continuing during the adult years. These uniquely human functions appear late during development, and their emergence may be aided by late persistence of exuberant synapses in prefrontal cortex.117

This recognition of physical differences in the development of brain regions involved in judgment, and in particular the hypothesis that development may continue into the adult years, also matched the development in the nonneurological study of moral development by scientists such as Kohlberg.

2. Recognition of a Second Period of Development

As the later studies in the previous section indicate, the recognition of extended development of the brain was not a scientific revolution. Those studies already indicated that there was development going on in the teen years, but the availability of new technology made possible the far more detailed study of that development. There had been a shortage of teenage brains from autopsy. While autopsy studies had an adequate supply of tissue from adults and from infants, a lower mortality rate in children provided smaller samples.118 This void would be filled by magnetic resonance imaging ("MRI") studies. There were concerns over subjecting children and adolescents to MRI study. Only after considerable experience with MRI machines and finding no MRI-related health problems among technicians working with the machines, even among those who were pregnant, could the Ethics Review Board of the National Institutes of Health approve an MRI study of the brains of normal children, a study begun in 1991.119 Once begun, the MRI studies yielded surprising new findings.

Importantly, it became clear that in the process of synaptic development and pruning, it was not the case that all the development occurred in childhood, with only the pruning continuing into the second decade. Instead, there was a second period of rapid development around puberty, with gradual pruning occurring through adolescence and into young adulthood.120

The availability of MRI allowed the longitudinal study of individual brains. Rather than comparing autopsied brains from different individuals at their ages of death, researchers could study the changes in a particular brain over time. Such longitudinal studies, of course, involve the passage of time, and the publication of

117 Id. at 178 (citations omitted).
118 See id. at 171; STRAUCH, supra note 78, at 12 ("One big stumbling block in studying the brains of teenagers has been that relatively few of them die.").
119 See STRAUCH, supra note 78, at 72.
120 See id. at 19–20.
results came in the late 1990s. Again, the original results are not easy reading, and
the developing secondary sources that have become available in the early 2000s
are of value to the nonscientist. 121

Dr. Jay Giedd, and his colleagues at the National Institute of Mental Health,
conducted one of the early longitudinal neuroscience examinations. 122 That study
involved 145 healthy individuals aged 4.2 to 21.6 years, with the majority
undergoing multiple MRI scans at approximately two year intervals. 123 The results
showed increases in cortical gray matter in the preadolescent years with a
postadolescent decrease; the peaks of development varied among the different
regions of the cortex.124

Another study published in the same journal issue as the Giedd study showed
similar results. U.C.L.A. Professor Elizabeth Sowell and colleagues compared
MRI studies of the brains of adolescents and of young adults. 125 The comparison
between the twelve- to sixteen-year-old group and the twenty-three to thirty group
showed differences: "In regions of the frontal cortex, we observed reduction in
gray matter between adolescence and adulthood . . . . [T]he frontal lobes are
essential for such functions as response inhibition, emotional regulation, planning
and organization. Many of these aptitudes continue to develop between
adolescence and young adulthood."126

Still another study, published the next month in the same journal, indicated
the function and importance of the areas still under development in the adolescent
and postadolescent years. That study, led by Professor Antonio Damasio of the
University of Iowa, was based on a study of the behavior of two individuals who
had suffered early physical injury to a portion of the cortex. 127 The two
individuals had suffered injury to the prefrontal cortex, 128 one having been run
over at age fifteen months and the other having had a tumor in the region removed
at age three months. 129 They both exhibited what the scientists described as
"severely impaired social behavior despite normal basic cognitive abilities," were
insensitive to the consequences of their behavior, and were not amenable to
correction of their behavior through punishment. 130 While adults suffering similar
injuries also exhibit behavioral problems, those suffering the injuries in early

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121See, e.g., id. at 11–21 (discussing current research on adolescent brain development).
122See Jay N. Giedd et al., Brain Development During Childhood and Adolescence: A
123Id.
124Id.
125See Elizabeth R. Sowell et al., In Vivo Evidence for Post-Adolescent Brain Maturation in
Frontal and Striatal Regions, 2 NATURE NEUROSCIENCE 859, 859 (1999).
126Id. at 860 (citations omitted).
127See Steven W. Anderson et al., Impairment of Social and Moral Behavior Related to Early
Damage in Human Prefrontal Cortex, 2 NATURE NEUROSCIENCE 1032, 1032–33 (1999).
128The prefrontal cortex is that outer layer of the brain found directly behind the forehead. See
STRAUCH, supra note 78, at 27.
129Anderson et al., supra note 127, at 1032–33.
130Id. at 1032.
childhood had additional defects in the ability to reason morally, a deficiency not found in adult patients.\textsuperscript{131}

The two patients who had suffered early injuries engaged in moral reasoning characteristic of the preconventional stage of the ten year old.\textsuperscript{132} They had been left behind when other children moved to higher levels of moral development: "The patients demonstrated limited consideration of the social and emotional implications of decisions, failed to identify the primary issues involved in social dilemmas and generated few response options for interpersonal conflicts."\textsuperscript{133} In contrast those injured as adults could "access the 'facts' of social knowledge,"\textsuperscript{134} were more constrained, and were able to call on the moral reasoning that they had developed prior to their injuries.\textsuperscript{135}

The results of the MRI studies quickly moved from journals specializing in neuroscience to the more general psychological literature. In 2000, an overview of the developmental process appeared that summed up brain development in adolescence and noted similarities to development in other species.\textsuperscript{136} The behavior of adolescents, once attributed solely to hormonal changes, was seen as affected more by physical changes in the brain.

This remodeling of the brain is seen in adolescents of a variety of species and entails not only brain growth, including the formation of additional connections between nerve cells, but also a prominent loss (or pruning) of such connections in particular neural regions. Among the brain areas prominently remodeled . . . is the prefrontal cortex, a brain region thought to be involved in various goal-directed behaviors . . . and in emotional processing . . . . Along with a decline in the relative size of the prefrontal cortex during adolescence, there is substantial remodeling of connections between neurons—with some connections lost and others added.\textsuperscript{137}

The author concluded that, given brain differences, it would be "astonishing indeed if adolescents did not differ from adults in various aspects of their motivated behavior."\textsuperscript{138}

While a popular literature soon began to develop, it was not until the 2003 publication of New York Times science editor Barbara Strauch’s book, The Primal Teen: What the New Discoveries About the Teenage Brain Tell Us About Our

\begin{itemize}
  \item \textsuperscript{131}See id.
  \item \textsuperscript{132}Id. at 1033.
  \item \textsuperscript{133}Id.
  \item \textsuperscript{134}Id.
  \item \textsuperscript{135}Id. at 1034–35.
  \item \textsuperscript{136}See Linda Patia Spear, Neurobehavioral Changes in Adolescence, 9 CURRENT DIRECTIONS PSYCHOL. SCI. 111, 111 (2000).
  \item \textsuperscript{137}Id. at 112–13.
  \item \textsuperscript{138}Id. at 113.
\end{itemize}
Kids, that a description appeared that is both detailed and readable. Strauch sums up research on what neurology now tells us; it is a story of development that is far from complete in early childhood.

Over a span of roughly ten to twelve years, the adolescent brain, through a series of sometimes subtle and sometimes breathtakingly dramatic shifts, is transformed from child to adult. The gray matter of an adolescent’s frontal lobes grows denser and then abruptly scales back, molding a leaner thinking machine. The teenage brain fine-tunes its most human part, the prefrontal cortex, the place that helps us cast a wary eye, link cause to effect, decide “maybe not”—the part, in fact, that acts grown-up.

The process takes place not only in the teen years, but into the twenties.

C. General Implications of the New Findings in Neuroscience

One major impact of the new neuroscience is the recognition of the effect of the environment and the child’s experiences in the development of the brain and its response to stimuli. It has long been recognized that an infant’s environment affects his or her cognitive development. This is established to the point that the Association for Supervision and Curriculum Development has published a guide for educators, titled Teaching with the Brain in Mind, that offers suggestions for enriching the environment to foster cognitive development. While genes play a role in the physical development and the “wiring” of the brain, environment is seen as having its own impact at the level of forty to seventy percent of the total influence. Studies somewhat older than the recent MRI studies showed that environmental stimulation resulted in a thicker cortex with more dendritic branching. Strauch also recounts rat studies showing that rats raised in a rich environment—one with more toys to provide a variety of experience—developed a thicker cortex and were relatively quicker at finding their ways through mazes.

In the overblooming and later paring of synapses in the cognitive portions of the brain, it is experience that determines which synapses are pared and which remain a part of the wiring of the brain. While the process by which we remember things is not completely understood, it is clear that long-term memory

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139See STRAUCH, supra note 78, at 3–9.
140Id. at 203–04.
141Id. at 204.
142ERIC JENSEN, TEACHING WITH THE BRAIN IN MIND (1998).
143Id. at 30.
144See id.
145See STRAUCH, supra note 78, at 38–39.
146See JENSEN, supra note 142, at 32.
involves physical changes in the brain’s neural connections. Anything we remember from our past—our lessons in first grade or shooting a character in a video game—is remembered because it caused a physical change in our brains.

It is thus unsurprising that the environment, during the time the prefrontal cortex develops, could affect that development. And since that portion of the brain is vital in judgment and inhibition, the developmental environment would seem capable of affecting those important brain functions. Indeed, environment has been shown to affect behavior in rats.

A study of male rats that had been isolated as juveniles and not allowed to engage in normal rough and tumble play showed that their subsequent adult sexual behavior was altered. Furthermore, there were physical differences in their brains with a reduction in the size of two regions that are normally stimulated in sexual situations. Strauch puts it in plainer language:

Much of the basic brain development is driven by genes, but many connections, some dendrite branches and their synapses, develop and thrive simply because they’re used the most and grab the most neurochemical juice. . . . [T]he principle of “use it or lose it” . . . means that certain life experiences—good and bad—can have an impact on the brain’s essential architecture.

The teenage years, during which the brain is rewired, constitute a critical period when there should be great concern over environmental influences and a recognition that what is experienced will affect that development. Strauch relates an interview with Dr. David Fassler, the chair of the American Psychiatric Association’s Council on Children, Adolescents and Their Families: “As science continues to show how behavior and brain structure dance in tandem—anatomy influences emotions and experiences, and emotions and experiences, in turn, alter

147 See id. at 100-09.
148 There has been criticism of localization of behavioral or cognitive states. See, e.g., Martin Sarter et al., Brain Imaging and Cognitive Neuroscience: Toward Strong Inference in Attributing Function to Structure, 51 AM. PSYCHOLOGIST 13, 13 (1996) (providing “[a] conceptual framework to advance the interpretation of data describing the relationship between cognitive phenomenon and brain structure activity”). Mapping mental states such as contentedness or self-confidence to particular brain states would seem particularly troublesome, but Sarter and his colleagues also point to problems in mapping less complex mental states and acts. Id. For example, they suggest that parts of the brain other than those identified may be involved, even if at a level of activity below that which can be detected. Id. at 14–15. Nonetheless, the prefrontal cortex is involved in judgment, even if other regions also come into play, and that involved region is only developing in adolescence.
150 Id. at 111.
151 STRAUCH, supra note 78, at 17.
152 See id. at 21.
the fundamental architecture of the brain—we do have to be more concerned, he says, about certain kinds of experiences teenagers may have.153

If, as neurology now teaches us, the teenage years are a period in which the brain is in the process of development, society should be concerned about the influences to which both children and adolescents are exposed. Experiences cause physical changes in the brain, and those physical changes affect the way that people react to future stimuli. Some experiences may, over the long run, be sufficiently negative in their effect on the healthy development of children that limitations should be allowed.

There is a second area, without negating the possibility of still others, in which the new findings of neuroscience should impact on law and social policy. That second area is the field of juvenile justice. One of the main tasks of the brain, particularly of the more evolved parts of the brain, is to inhibit actions. “[A]s the brain develops—in children and, science is now learning, in teenagers—it is this very inhibition machinery that is being fine-tuned. . . . [W]hat can we expect of adolescents if that inhibition machinery, the prefrontal cortex, is not yet fully tuned?”154 Children, including teenagers, may simply not be as capable as adults at inhibiting behavior. There is also evidence that this same lesser development of the same region of the brain makes it less likely that children will recognize the consequences of their acts.155

It is also worth pointing out, once again, that work by such researchers as Piaget and (more so) Kohlberg showed a process of development in moral reasoning going far beyond early childhood.156 Neuroscience now provides an explanation of that extended period of development. While the brain may be sufficiently developed for many tasks in early childhood, when it comes to inhibition and understanding consequences vital to moral reasoning, the wiring for the task is not complete.

II. SHIELDING YOUTH FROM NEGATIVE MEDIA INFLUENCES

A. Juveniles and Sexual Depictions

Juveniles are already protected from exposure to sexual images, in the sense that there are legal restrictions on nonobscene, pornographic material for those under seventeen. The Supreme Court, in Ginsberg v. New York,157 upheld a conviction for the sale of a “girlie magazine” to a sixteen-year-old boy, in violation of a New York statute making it a crime “knowingly to sell . . . to a minor . . . any picture which depicts nudity, sexual conduct or sado-masochistic

153Id. at 212.
154Id. at 32.
155See id. at 91.
156See supra notes 30–77 and accompanying text (explaining cognitive development theories of Piaget and Kohlberg).
157390 U.S. 629 (1968).
"Harmful to minors" was defined as material depicting nudity, sexual conduct, sexual excitement, or sadomasochistic abuse that "(i) predominantly appeals to the prurient, shameful or morbid interest of minors, and (ii) is patently offensive to prevailing standards in the adult community as a whole with respect to what is suitable material for minors, and (iii) is utterly without redeeming social importance for minors."  

While the definition mirrored that then used for obscenity, the material, simply provocatively posed female nudes, would not have been obscene when distributed to adults. The Court accepted a variable definition for "obscene," when children were the consumers. The Court accepted an approach to obscenity first proposed by Professors Lockhart and McClure, quoting their explanation of the concept.

"Variable obscenity . . . furnishes a useful analytical tool for dealing with the problem of denying adolescents access to material aimed at a primary audience of sexually mature adults. For variable obscenity focuses attention upon the make-up of primary and peripheral audiences in varying circumstances, and provides a reasonably satisfactory means for delineating the obscene in each circumstance."  

Thus, children are protected from images that are legally available to adults. Seemingly more general in its analysis, although clearly talking about sexual material, the Court said that the state's power to control children's conduct is more expansive than the analogous power over adults.

"The world of children is not strictly part of the adult realm of free expression. The factor of immaturity, and perhaps other considerations, impose different rules. Without attempting here to formulate the principles relevant to freedom of expression for children, it suffices to say that regulations of communication addressed to them need not conform to the requirements of the first amendment in the same way as those applicable to adults." 

A second Supreme Court case backs up this recognition that children may be shielded from influences that are constitutionally protected for adult consumption.

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158 Id. at 647, app. A (quoting N.Y. PENAL LAW § 484-h(2) (1965)).
159 Id. at 646, app. A (quoting N.Y. PENAL LAW § 484-h(1)(f) (1965)).
160 Id. at 638.
161 Id. at 635 n.4 (quoting William B. Lockhart & Robert C. McClure, Censorship of Obscenity: The Developing Constitutional Standards, 45 MINN. L. REV. 5, 85 (1960)) (alteration in original).
162 Id. at 638.
163 Id. at 638 n.6 (quoting Thomas I. Emerson, Toward a General Theory of the First Amendment, 72 YALE L.J. 877, 938–39 (1963)).
Federal Communications Commission v. Pacifica Foundation\textsuperscript{164} grew out of the broadcast of comedian/social satirist George Carlin's "Filthy Words" monologue. In a decision brought back into the spotlight by the Janet Jackson Super Bowl breast exposure and the broadcasts of Howard Stern and Bubba the Love Sponge, the Court ruled that the FCC could, consistent with the First Amendment, require that indecent material be broadcast only in hours when children are less likely to be in the audience, a restriction that would actually also have some impact on adults.\textsuperscript{165}

It is interesting that the Court has allowed these restrictions, despite the lack of scientific evidence of harm to children. The New York legislature, in enacting the statute at issue in \textit{Ginsberg}, had asserted that the material addressed was ""a basic factor in impairing the ethical and moral development of our youth and a clear and present danger to the people of the state.""\textsuperscript{166} But this conclusion lacked a firm foundation. The Court recognized this, but nonetheless found the New York legislature's concern to be rational.\textsuperscript{167} Since the material was unprotected because it was obscene when distributed to children, the Court did not require scientifically certain conclusions—only required the belief in harm be rational.\textsuperscript{168}

It is unsurprising that scientific evidence of harm from sexual material is lacking. It is, of course, possible that the evidence does not exist because the harm does not exist. On the other hand, exposure to sexual material could possibly affect minors' views on women or on the appropriateness of themselves engaging in early sexual behavior. If these possible conclusions are speculative, they will most likely remain that way. Given the law on exposing minors to sexual material and ethical concerns over any study that would propose to do so, laboratory studies in which children are exposed to sexual depictions should not be expected.

\textbf{B. Media Violence and Children}

\textit{1. Research on the Passive Media}

Lack of scientific evidence for the effect of sexual material on children does not carry over to the effects of media violence. There are decades of studies and metastudies on the impact of violence in television and film. While there are hold

\textsuperscript{164}438 U.S. 726 (1978).
\textsuperscript{165}Id. at 750–51. \textit{United States v. Playboy Entertainment Group, Inc.}, 529 U.S. 803 (2000), shows some limits on the willingness of the Court to allow restrictions aimed at shielding children. There, the Court struck down requirements that cable channels with primarily sexual content fully scramble their signal or not provide the programming during hours when children were likely to be in the audience. \textit{Id.} at 826–27. The decision does not, however, signal a change in the willingness to allow the shielding of children from sexual material. It instead was an insistence that the rights of adults not be restricted in the effort, when there are ways to protect children that have less effect on adults.
\textsuperscript{166}\textit{Ginsberg}, 390 U.S. at 641 (quoting N.Y. \textsc{Penal Law} § 484-e (1965)).
\textsuperscript{167}\textit{Id.} at 643.
\textsuperscript{168}See \textit{id.} at 642–43.
outs from the conclusion—and the media industry is certainly skeptical—the aggregate of these decades of psychological studies demonstrates that there is a connection between violence in the media and violence in the real world. In July of 2000, six major organizations of health professionals found the scientific evidence conclusive. In a joint statement, the American Psychological Association, the American Academy of Pediatrics, the American Academy of Child and Adolescent Psychiatry, the American Medical Association, the American Academy of Family Physicians and the American Psychiatric Association concluded that "well over 1,000 studies . . . point overwhelmingly to a causal connection between media violence and aggressive behavior in some children."\(^{169}\)

In an earlier policy statement, the American Academy of Pediatrics had expressed a similar view: "The vast majority of studies conclude that there is a cause-and-effect relationship between media violence and real-life violence."\(^{170}\) The AAP called the link "undeniable and uncontestable."\(^{171}\) An AAP representative, testifying before the United States Senate Commerce Committee, said that, in 2000, there were 3500 studies that examined the relationship between media violence and real world violence, and "[a]ll but 18 have shown a positive correlation between media exposure and violent behavior."\(^{172}\) Furthermore, the same testimony asserted that epidemiological studies conclude "that exposure to violent media was a factor in half of the 10,000 homicides committed in the United States [in the year studied]."\(^{173}\)

The scientific community has firmly concluded that the debate about the effects of media violence is over and that there is a clear connection between media violence and real world aggression. While the Surgeon General’s report *Youth Violence* noted that ethical considerations bar the randomized studies best used to establish causation, it concluded that "a diverse body of research provides strong evidence that exposure to violence in the media can increase children’s aggressive behavior in the short term."\(^{174}\) The report was less sure in asserting a causal connection to violence in the long-term but found a "small but statistically significant impact on aggression over many years."\(^{175}\)


\(^{171}\) Id.


\(^{173}\) Id.


\(^{175}\) Id.
2. Video Games

Most of the research on the effects of media violence has studied the passive media of film or television. The effects of video games, with their more active engagement in virtual violence, have been less studied because of their more recent vintage and a concern that has more recently developed as the games become more realistic in their depictions of violence. Since video games still involve the same reception of images found in the passive media, the effects should be no less certain than the effects for film and television. Given the role-playing and character identification involved in video games, it seems reasonable to believe that the effects would, in fact, be stronger.

While research on the effects of violent video games is less developed than that for the passive media,176 studies on modern violent video games do exist. In 2000, Professors Craig Anderson and Karen Dill published a comparison of the effects of violent and nonviolent video games on aggression.177 They conducted two studies, a correlational/demographic variable study and a laboratory experiment. The correlational study examined 227 university students. The students answered questions regarding their present exposure to video games generally and to violent video games specifically, and their past exposure to such games in their secondary school years. They were also tested for irritability, physical and verbal aggression, anger, hostility, and history of delinquent acts. After analyzing the data, Anderson and Dill concluded that violent video game play was more strongly correlated with delinquency than was nonviolent video game play and that "concern about the deleterious effects of violent video games on delinquent behavior, aggressive and nonaggressive, is legitimate. Playing violent video games often may well cause increases in delinquent behaviors, both aggressive and nonaggressive."178

While Anderson and Dill were reluctant to draw a conclusion regarding causation from the correlational study,179 the laboratory study provided the evidence needed for the conclusion. That study compared playing Myst, a game designed to be nonviolent, with Wolfenstein 3D, a game with a realistic, three-dimensional environment and very violent graphics where "a successful player

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176There is early research on violent video games, but the games have changed so much in the realism of their violent depictions that older studies may lack relevance. For example, a study comparing the effects of playing Pac-Man with those of playing Missile Command does not measure the effects of today's more violent and more realistic games. See Joel Cooper & Diane Mackie, Video Games and Aggression in Children, 16 J. APPLIED SOC. PSYCHOL. 726, 730 (1986). The earlier games were far less violent, to the point that Cooper and Mackie suggest that children may not really see a significant difference in violence between Pac-Man eating or being eaten by ghosts and Missile Command's destruction of invading alien space ships. See id. at 740–42.

177See Craig A. Anderson & Karen E. Dill, Video Games and Aggressive Thoughts, Feelings, and Behavior in the Laboratory and in Life, 78 J. PERSONALITY & SOC. PSYCHOL. 772, 772 (2000).

178Id. at 782.

179Id.
will see multiple bloody murders and hear victims scream and groan."\(^{180}\) The two games matched each other in difficulty, frustration, enjoyment, level of action and effect on player blood pressure and heart rate.\(^{181}\)

The study again involved over 100 university students sorted by a measure of their irritability as low or high and by sex. The members of each of the four groups were then evenly divided into two groups and assigned to play either *Wolfenstein 3D* or *Myst*. After playing the game three times, they were told that they would participate in a competitive reaction time test. If a participant lost, he or she would be subjected to a noise blast at an intensity and duration said to be determined by the competitor but actually set by the experimenters. Prior to each trial, the subjects set the duration and intensity of the noise blast his or her opponent would hear, if the participant won the trial, and after each trial, the participant was shown the level supposedly set by the opponent. The experimenters summarized their results: "[P]articipants who had played *Wolfenstein 3D* delivered significantly longer noise blasts after losing trials than those who had played the nonviolent game *Myst* . . . . In other words, playing a violent video game increased the aggressiveness of participants after they had been provoked by their opponent’s noise blast."\(^{182}\)

Anderson and Dill concluded that the correlational and laboratory results together support a claim of causation: "The convergence of findings across such disparate methods lends considerable strength to the main hypothesis that exposure to violent video games can increase aggressive behavior."\(^{183}\) While the results may not have been unexpected: given the results of research on the passive media, they suggest that violent video games should be of even more concern, because the player identifies with the game’s aggressor character and actively—even if virtually—participates in the violence. "In a sense, violent video games provide a complete learning environment for aggression, with simultaneous exposure to modeling, reinforcement, and rehearsal of behaviors. This combination of learning strategies has been shown to be more powerful than any of those methods used singly."\(^{184}\)

Anderson, along with Professor Bushman, also published a 2001 meta-analysis of the then-existing research on the effects of violent video games.\(^{185}\) The meta-analysis examined thirty-five research studies.\(^{186}\) Most of them were experimental or laboratory studies, but some field studies were included.\(^{187}\) The

\(^{180}\) Id. at 783.
\(^{181}\) Id. Male players reported they found *Wolfenstein 3D* more exciting than *Myst*, despite the similar physical responses; the view was not shared by female subjects. See id.
\(^{182}\) Id. at 786.
\(^{183}\) Id. at 787.
\(^{184}\) Id. at 788 (citations omitted).
\(^{186}\) Id. at 356.
\(^{187}\) Id.
authors concluded from their meta-analysis that "[v]iolent video games increased aggression in males and females, in children and adults, and in experimental and nonexperimental settings." The experimental studies show that "short-term exposure to violent video games causes at least a temporary increase in aggression," while the nonexperimental studies demonstrate that "exposure to violent video games is correlated with aggression in the real world."

By the time of the two video game studies discussed, Lt. Col. Dave Grossman, who formerly taught psychology at the United States Military Academy, had expressed concern. While not offering laboratory studies of his own on effects of video games on children, he argued that conclusions may be drawn from the military’s experiences. Studies of soldiers in combat found a strong unwillingness to kill that resulted in a firing rate at the enemy in the neighborhood of only twenty percent in World War II. Recognizing a problem, the military moved to change the firing rate: by the Korean War, the firing rate increased to fifty-five percent, and—with more refinement in training—to between ninety to ninety-five percent in the Vietnam War.

The earlier form of "real world" training to increase the firing rate involved the use of pop-up figures, but the better, later training has come from computer simulations. Using computers, military trainees “learn how to shoot, where to shoot, how to maneuver through possibly deadly combat situations, how to tell enemy from friend, and, most important, how to kill. The entire event of killing in

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188 Id. at 357. One study has caused a court in 2002 to call the science on the effect of violent video games "somewhat equivocal." See Wilson v. Midway Games, Inc., 198 F. Supp. 2d 167, 182 n.33 (D. Conn. 2002). The study was conducted by Australian researchers Michele Fleming and Debra Rickwood. See Michele J. Fleming & Debra J. Rickwood, Effects of Violent Versus Nonviolent Video Games on Children’s Arousal, Aggressive Mood, and Positive Mood, 31 J. APPLIED SOC. PSYCHOL. 2047 (2001). It found no correlation between violent video game play and aggression, but used a game of a far different nature than those in the other studies. Id. at 2064. The “violent game” played by the eight- to twelve-year-olds, Herc’s Adventure, put the player in the role of Herc, traveling through ancient Greece to rescue Persephone from Hades, and in the process slaying Cyclops monsters and skeletons. The study’s authors note that the failure to find an aggressiveness inducing effect may simply result from the game not being seen as very violent. Id. Ethical concerns led them to choose a “very ‘mild’ game.” Id. The game was rated as appropriate for children age eight and older, id. at 2052–53, so it is unsurprising that playing the game had no negative effect on children whose average age was ten years, six months. Id. at 2053. The authors themselves suggest that a more violent game may have led to a different result. Id. at 2064–65.

189 Anderson & Bushman, supra note 185, at 357 (emphasis added).

190 Id.

191 See LT. COL. DAVE GROSSMAN, ON KILLING: THE PSYCHOLOGICAL COST OF LEARNING TO KILL IN WAR AND SOCIETY, at xxi–xxiii, 302 (1995); LT. COL. DAVE GROSSMAN & GLORIA DEGAETANO, STOP TEACHING OUR KIDS TO KILL: A CALL TO ACTION AGAINST TV, MOVIE AND VIDEO GAME VIOLENCE 2–4, 10 (1999).

192 See GROSSMAN, supra note 191, at 250 (“In World War II, 75 to 80 percent of riflemen did not fire their weapons at an exposed enemy, even to save their lives and the lives of their friends.”); GROSSMAN & DEGAETANO, supra note 191, at 72 (“[T]he firing rate was a mere 15 percent among riflemen . . . .”)

193 GROSSMAN, supra note 191, at 251.
combat can be simulated by a computer.”194 The simulators used are very similar to the video games currently played by children,195 but children play the games without also being taught the discipline and responsibility that is taught in the military.

It is also important to note the skill level that may be attained through video game play. Even one reluctant to accept the psychological evidence of causation must recognize that, wherever the inclination may come from, training can make for a more effective killer. A strong case is found in the shootings at Heath High School in the Paducah, Kentucky area.196 Michael Carneal used a hand gun to kill three students leaving a before-school prayer meeting; he wounded five others. According to his lawyer, Carneal had “no appreciable exposure to firearms,”197 yet with eight198 or nine199 shots, he had eight hits, all in the head or upper torso. This level of accuracy with a handgun is astounding. “The FBI says that the average experienced law enforcement officer, in the average shootout, at an average range of seven yards, hits with approximately one bullet in five.”200

Where does a fourteen-year-old with no appreciable firearms experience develop such expertise? It is known that he was a player of the violent video games Doom, Quake, and Redneck Rampage.201 Grossman finds a basis for his deadly skill in that play.

Carneal] never moved his feet during his rampage. He never fired far to the right or left, never far up or down. He simply fired once at everything that popped up on his “screen.” It is not natural to fire once at each target. The normal, almost universal, response is to fire at a target until it drops and then move on to the next target. This is the defensive reaction that will save our lives, the human instinctual reaction—eliminate the threat quickly. Not to shoot once and then go on to another threat before the first target has been eliminated. But most video games teach you to fire at each target only once, hitting as many targets as you can as fast as you can in order to rack up a high score.

194GROSSMAN & DEGAETANO, supra note 191, at 72.
195Grossman and DeGaetano say that the United States Army’s simulator Multipurpose Arcade Combat Simulator is a modification of the Super Nintendo game Duck Hunt and that the Fire Arms Training Simulator used by many law enforcement agencies is “more or less identical” to the video game Time Crisis. See id. at 74.
198See id.; GROSSMAN & DEGAETANO, supra note 191, at 75–76.
200GROSSMAN & DEGAETANO, supra note 191, at 4.
201For assertions regarding the role of video games in the Heath High School killings, see James v. Meow Media, Inc., 90 F. Supp. 2d 798, 800–01 (W.D. Ky. 2000); GROSSMAN & DEGAETANO, supra note 191, at 75–76; Cheves, supra note 197; Prichard, supra note 199.
And many video games give bonus effects . . . for head shots.\textsuperscript{202}

Whatever Carneal's motivation to kill, his skill and reaction seem to have come from violent video game play.

That was the state of research at the time that the disconnect between the case law and science might have begun to show. Two cases contesting the ability of government to limit youth access to violent video games reached U.S. Courts of Appeals. The first, \textit{American Amusement Machine Ass'n v. Kendrick},\textsuperscript{203} grew out of Indianapolis's attempts to restrict play in arcades by those under age eighteen.\textsuperscript{204} The Seventh Circuit, in an opinion by Judge Posner, rejected any link between video game violence and violence in the real world and found no reason to single out from the array of popular violent media video games.\textsuperscript{205} Responding to the social science research, the court found: "The studies do not find that video games have ever caused anyone to commit a violent act, as opposed to feeling aggressive, or have caused the average level of violence to increase anywhere."\textsuperscript{206} Despite all the empirical evidence on the effects of violence in the passive media and despite the conclusions of the major health organizations that media violence causes real world violence, Judge Posner wrote that "common sense says that the City's claim of harm to its citizens from these games is implausible, at best wildly speculative."\textsuperscript{207}

The court also rejected specific concerns that the interactivity of video games makes causation even more likely than for passive media.\textsuperscript{208} Judge Posner called that distinction "superficial."\textsuperscript{209}

Maybe video games are different. They are, after all, interactive. But this point is superficial, in fact erroneous. All literature (here broadly defined to include movies, television, and the other photographic media, and popular as well as high brow literature) is interactive; the better it is, the more interactive. Literature when it is successful draws the reader into the story, makes him identify with the characters, invites him to judge them and quarrel with them, to experience their joys and sufferings as the reader's own.\textsuperscript{210}

But the court, in its response, equivocates with respect to two different uses of the word "interactive." Literary interaction, to which Judge Posner appeals, is

\textsuperscript{202}GROSSMAN & DEGAETANO, supra note 191, at 75–76.
\textsuperscript{203}244 F.3d 572 (7th Cir. 2001).
\textsuperscript{204}Id. at 573.
\textsuperscript{205}Id. at 575–79.
\textsuperscript{206}Id. at 578–79.
\textsuperscript{207}Id. at 579.
\textsuperscript{208}Id. at 577.
\textsuperscript{209}Id.
\textsuperscript{210}Id.
simply reader empathy with a character. This is nowhere near the same as the interactivity of participating in the action of a video game. It is like the difference between being in a play's audience and being on stage. The audience may empathize; the actor interacts. The interactivity of a flight simulator is a different experience, and is more likely to lead to a desired response in actual flight than reading a flight manual or a book on flying. 211

The Eighth Circuit, in Interactive Digital Software Ass'n v. St. Louis County,212 reached a similar conclusion regarding dangerousness. The court called the conclusion of a video-game study a "vague generality [that fell] far short of a showing that video games are psychologically deleterious."213 It called other studies "ambiguous, inconclusive, or irrelevant,"214 and complained that some studies were irrelevant because they were conducted on adults rather than minors.215 The relevance complaint ignores ethical concerns that a researcher might have in exposing minors to violent video games in a laboratory study. It seems to rest on the unlikely possibility that an effect on adults would not carry over to children—who are usually considered more impressionable.

While the cases presented rejected certain scientific evidence, it is important to note that they do not really have any lasting precedential value. Their legal conclusions relied on factual analysis; the courts concluded that the evidence submitted was inadequate to overcome the strict scrutiny demanded of restrictions on expression.216 They did not conclude, nor could they conclude, that there will never be adequate evidence. As long as psychologists continue to study media effects generally or video game effects specifically, any challenge to a new legislative restriction must be tested against the body of evidence developed to that point.

There has, in fact, been further study in the brief time since these cases were decided, and that additional research further supports the concerns over the effects of violent video games. A 2003 article in the American Psychological Association's journal, Psychological Science in the Public Interest, brought together the most prominent—or at least among the most published—scholars studying the effects of violent media.217 The article discussed media violence

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211 Even if the Seventh Circuit Court's point that all good literature or film is interactive is true, violent video games are particularly dangerous because of the degree of interactivity. Participation may increase identification with the game's character, and studies show that subjects who identify with a media aggressor are more likely to become aggressive. See Anderson & Dill, supra note 177, at 788 (citing J.P. Leyens & S. Picus, Identification with the Winner of a Fight and Name Mediation: Their Differential Effects upon Subsequent Aggressive Behavior, 12 Brit. J. Soc. & Clinical Psychol. 374–77 (1973)).

212 329 F.3d 954 (8th Cir. 2003).

213 Id. at 959.

214 Id.

215 Id.

216 See id. at 960; Am. Amusement Mach. Ass'n v. Kendrick, 244 F.3d 572, 579 (7th Cir. 2001).

217 See Craig A. Anderson et al., The Influence of Media Violence on Youth, 4 Psychol. Sci.
generally and reaffirmed the conclusions of the major health organizations; a portion of the article addressed violent video games specifically.218 The authors examined randomized experiments and cross-sectional surveys that existed at the time of the recent court decisions, but also looked at more recently developed longitudinal studies.219 The longitudinal studies, by their nature, took longer to conduct. With the recent development of more violent video games, they lagged behind longitudinal studies for other media. The authors cited two such studies, published in 2003. They showed a positive, statistically significant relationship between aggressiveness and both violent and general video game play.220

Longitudinal studies can be particularly useful, since they can shed light on the possibility that any correlation between video game play and aggressiveness is explained by the theory that children predisposed to violence choose to play violent games, rather than such game play causing aggressiveness or violence. The studies controlled for such a possibility by assessing aggressiveness at both the beginning and the end of the studies. Preexisting levels of aggressiveness were factored out to determine the effects of the games on children. Both studies, when controlled for levels of earlier aggressiveness, suggested that playing violent video games correlated with later aggressiveness.221 The authors recognize that there are factors—the relatively short duration of the study would seem one—that make the conclusions less strong, but they call both studies “strongly suggestive.”222 Putting all the studies then-available together, they conclude:

These studies offer support for a connection between playing violent video games and increased likelihood of engaging in aggression. The experimental studies demonstrate that in the short term, violent video games cause increases in aggressive thoughts, affect, and behavior; increases in physiological arousal; and decreases in helpful behavior. The cross-sectional studies link repeated exposure to violent video games with aggressive and violent behavior in the real world. The longitudinal studies further suggest long-term effects of repeated exposure to violent video games on aggression and violence.223

Still more recently, an issue of the Journal of Adolescence was devoted to the subject of video game effects and presented the results of a number of researchers. One of the studies involved over 600 eighth- and ninth-graders and concluded that

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218Id.
219See id. at 90–91.
220See id. at 91 (citing Michael D. Slater et al., Violent Media Content and Aggressiveness in Adolescents: A Downward Spiral Model, 30 COMM. RES. 713, 713–36 (2003); Nobuko Ibori et al., Does Video Game Use Grow Children’s Aggressiveness?: Results from a Panel Study, in SOCIAL CONTRIBUTIONS AND RESPONSIBILITIES OF SIMULATION & GAMING 221 (K. Arai ed., 2003)).
221Id.
222Id.
223Id. at 92–93.
those exposed to more video game violence "were more hostile, reported getting into arguments with teachers more frequently, were more likely to be involved in physical fights, and performed more poorly in school." While the "which came first, violent video game play or aggressiveness?" question could be raised, the study showed that "low-hostile students who have the highest exposure to violent video games are more likely to have been involved in fights than high-hostile students who have the lowest exposure to violent video games."225

A second study in the issue involved 150 fourth- and fifth-grade students. It examined exposure to real world violence, to violence in a variety of media, and children's empathy and attitude toward violence. The study concluded that violent video game exposure was associated with lower empathy, and that exposure both to violent films and to violent video games was related to stronger "proviolence" attitudes.228

Still another study involved 121 college students age eighteen or slightly older. The students played either the violent game, Doom, or a nonviolent game; they were then administered a number of self-evaluation instruments. The researchers report that

participants who had played ... Doom ... subsequently associated the self more with aggressive traits and actions on an [implicit association test], but did not associate self with aggressive traits on a variety of self-report measures. These findings suggest that the short-term effects of game exposure on the self-concept ... were strongest at an automatic level.231

It thus appears from this study that even players who do not sense their own increase in aggressiveness at the conscious level do in fact become more aggressive at a level below full consciousness. As the authors put it, the study suggests that "violent media may exert their influence through multiple routes, some more amenable to conscious assent than others." The recent developments in neuroscience and the role of environment in the development of the regions of

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225 Id. at 18.
227 See generally id.
228 Id. at 23.
230 Id.
231 Id. at 48 (citation omitted).
232 Automatic processes include actions such as tying shoes—actions the individual steps of which do not require conscious effort. Peterson, supra note 84, at 148.
233 Uhlmann & Swanson, supra note 229, at 49.
the brain governing judgment and inhibition\textsuperscript{234} may explain this effect on automatic responses.

Finally, Professor Anderson provided an update of his meta-analysis of the body of research on violent video game play.\textsuperscript{235} His study produced three findings that he characterizes as important.

First, as more studies of violent video games have been conducted, the significance of violent video game effects on key aggression and helping-related variables has become clearer. Second, the claim (or worry) that poor methodological characteristics of some studies has led to a false, inflated conclusion about violent video game effects is simply wrong. Third, video game studies with better methods typically yield bigger effects, suggesting that heightened concern about the deleterious effects of exposure to violent video games is warranted.\textsuperscript{236}

It is clear that the evidence is continuing to develop. Thus, any prior court conclusions that science has not demonstrated causation between video game play and aggression must be reexamined with each new challenge to restrictive legislation. Unlike legal conclusions, empirically based conclusions are subject to regular revision in any developing field, and should not be seen as precedential.

That being said, it may in fact be something deeper that led to the Court's rejection of science. Judge Posner, in the Seventh Circuit opinion, wrote: "The studies do not find that video games have ever caused anyone to commit a violent act, as opposed to feeling aggressive, or have caused the average level of violence to increase anywhere."\textsuperscript{237} It is not clear what to make of this statement. Certainly, the laboratory studies have shown an increase in the average level of aggressiveness in the population of the study, and demographic studies do indicate higher levels of violence in populations regularly exposed to media violence. If the court is calling for laboratory studies in which the subjects must be given the opportunity to commit actual violence against another, that seems an unreasonable and unethical expectation. Furthermore, given experiments in which noise blasts or even electric shocks have been administered,\textsuperscript{238} it is not clear how

\textsuperscript{234}See \textit{supra} notes 142–53 and accompanying text.

\textsuperscript{235}See generally Craig A. Anderson, \textit{An Update on the Effects of Playing Violent Video Games}, 27 J. ADOLESCENCE 113 (2004). Not all of the studies in the issue are discussed here, and not all of the studies found negative results for video games. One study found that the cultivation effects of television violence, the belief among viewers of violent television that the world is a more violent place than it in fact is, are not present for video game play. See Jan Van Mierlo & Jan Vand den Bulck, \textit{Benchmarking the Cultivation Approach to Video Game Effects: A Comparison of the Correlates of TV Viewing and Game Play}, 27 J. ADOLESCENCE 97, 108 (2004). Since television violence is more likely to be portrayed in situations the viewer may face every day, while video games present more exceptional situations, the result seems unsurprising.

\textsuperscript{236}Anderson, \textit{supra} note 235, at 120.


\textsuperscript{238}For discussion relating to noise blast experiments in video games, see \textit{supra} notes 179–82.
much violence is required to establish the conclusion that violence—not just aggressiveness—results.

The earlier part of the court's comment—about studies failing to differentiate between aggressiveness and violence—seems to focus more on difficulties with causation. It is true that no specific case of violence can be laid squarely and solely at the doorstep of violent video games. Certainly most players of such games do not go on to commit violent acts in the real world, and not all who are violent in the real world are players of violent video games. But the same may be said of smoking and the development of lung cancer. Some may smoke for decades and not develop lung cancer, while others who have never smoked are afflicted. What is found in any study with an epidemiological quality is a correlation between one factor and another, not a conclusion with regard to the etiology of a specific case of disease or violence.

It is puzzling that the correlation between smoking and lung cancer is so clearly accepted as establishing causation, while courts have difficulty in accepting the same conclusions for violent video games. Some of this difference may result from the fact that the cigarette industry did not control the media through which public opinion is informed and formed. The media industry—the target of concerns over violence—does have that control. It also appears that the industry uses that power. A recent study in the American Psychological Association's journal, *American Psychologist*, found a "disheartening" discrepancy between the developing science and reports of it in the news media.\(^\text{239}\) "As it became clearer to the scientific community that media violence effects were real and significant, the news media reports actually got weaker."\(^\text{240}\) The study's authors also report specific instances in which *Newsweek* and the *New York Times* published articles or op-ed pieces rejecting the evidence on causation, and then refused to publish a reply from the science community.\(^\text{241}\)

It is also true that the degree of correlation between media violence and real world violence is not as strong as that between smoking and lung cancer, so that may be a reason for rejecting causation in the former and accepting it in the latter. However, the correlation between media violence and aggression is stronger than that between second hand smoke and lung cancer, lead exposure in children and lower IQs, use of the nicotine patch and smoking cessation, calcium intake and bone mass, homework and academic achievement, and asbestos exposure and cancer of the larynx.\(^\text{242}\)

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240 Id.
241 Id. at 486.
242 Id. at 481 fig.2.
So, a difference must still be found to explain the Court’s unwillingness to accept causation in the case of violent video games. That difference would seem to be an inability to understand the nature or mechanism of the causation involved. Even those who are not pulmonary scientists can understand how an irritant like cigarette smoke can lead to tissue changes in the lungs of smokers or those who inhale second-hand smoke. We may be at a loss to explain the cellular level effects, but the physical nature of the effect makes it seem more reasonable. The same is true for the nicotine patch. We do not really need to understand fully the biology of chemical receptors to appreciate that supplying nicotine through a patch could lessen the craving for nicotine through smoking. Much the same may be said of the other, more accepted, instances of causation. The mind or brain, however, seems more mysterious and the mechanism by which playing a game could cause a change in the mind or brain is concomitantly more difficult to understand.

It would appear that no matter how strong the correlation between media violence and real world violence may be demonstrated to be, there is still the skeptic’s response that all that had been shown is correlation rather than causation. To accept causation, something may have to be understood of the causal mechanism, and the new findings of neuroscience may provide that missing link. If the brain is in the process of developing during the teen years, and synapses are being pared based on environmental factors, causation of violence from violent media becomes at least as understandable as the causation present in the other cases. If virtually violent responses are sufficiently regular in video game play, the “wiring” for an actual violent response is strengthened, available, and more likely to be called on in real world situations.

A recent study of the effects of television on attention is relevant here. For decades, teachers have reported that their young students have trouble listening and paying attention. This was often blamed on an inability to compete with the attention-grabbing, fast-paced nature of television entertainment. But, it may well be due to factors other than the inability of teachers to be as entertaining as the television industry. A study published in 2004 in the journal Pediatrics studied the relationship between television viewing at the ages of one and three and attention problems at age seven. The ages studied for television viewing are the ages of synaptic paring in the cognitive regions of the brain, and the ages during which a child’s environment affects the synapses that survive as the cognitive machinery of the older child and adult. The study concluded that there was, in fact, a strong relationship; for every increase of one standard deviation in television viewing at age one, there was a twenty-eight percent

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245 See supra Part I.B.1.
increase in attention problems at age seven, with similar results for viewing at age three. Addressing the possibility that there is no causation or that attention problems lead to television viewing, the authors noted that their focus on viewing at ages one and three was at an age accepted to be younger than that at which the symptoms of ADHD (attention deficit hyperactivity disorder) are manifest. A commentary on the study, published in the same issue of *Pediatrics*, called for additional study of the mechanisms underlying the relationship and the identification of any specific causal variables, and went on to say:

Neuroscience increasingly confirms the power of environmental experiences in shaping the developing brain because of the plasticity of its neuronal connectivity. Thus, repeated exposure to any stimulus in a child’s environment may forcibly impact mental and emotional growth by either setting up particular circuitry (“habits of mind”) or depriving the brain of other experiences. This shaping process, which affects brain structure and function, seems to influence both cellular development and neurotransmitter regulation.

Here, then, is what appears to be a physical impact on the brain due to media input during the years when the cognitive regions are developing.

Studies of brain activity when viewing violence and when playing violent video games more specifically address the concern over the causal effects of those influences. In studies led by Professor John Murray on the effects of viewing violent and nonviolent material, researchers found, unsurprisingly, that both sorts of images activated the regions of the brain responsible for visual and auditory processing. There were, however, differences in the activation of other areas.

[Viewing TV violence selectively recruited right precuneus, right posterior cingulate, right amygdala, bilateral hippocampus and parahippocampus, bilateral pulvinar, right inferior parietal and prefrontal, and right premotor cortex. Thus, viewing TV violence appears to activate brain areas involved in arousal/attention, detection of threat, episodic memory encoding and retrieval, and motor programming. These patterns are similar to the memory storage of traumatic events by posttraumatic stress disorder patients.]

This should certainly cause great concern over the effects of these images on

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246 Christakis et al., *supra* note 244, at 710.
247 *Id.* at 711.
250 *Id.*
developing children. Put in terms more easily understood,

Blood flow increased to the youngsters’ right brain hemispheres, demonstrating emotional arousal. Brain areas that sense danger and energize the body for fight or flight were also activated. Gamers even engaged a section of the prefrontal cortex that showed they were physically prepared to emulate the blows they witnessed.

And increased activity in a brain region called the posterior cingulate proved that the images were being ‘burned’ into storage as vivid, persistent and traumatic memories. The team concluded that the children retained violent video-game images in a way that could influence their future behavior.\(^{251}\)

Another study of general video game play may also cause concern, specifically with violent games. Researchers studied video game players in the process of playing using a specialized positron emission tomography technique.\(^{252}\) Game play resulted in the release of dopamine, a neurotransmitter believed to be involved in learning and attention, sensorimotor integration, and, perhaps most importantly, the reinforcement of behavior.\(^{253}\) While reinforcement of behavior may produce a positive effect for some games, reinforcement of behavior from violent games would speak to the effects found by the social scientists.

Admittedly, these sources and studies are difficult to understand. The lay person is left somewhat at the explanatory mercy of the brain scientists. The important point here is that judges should recognize that they, too, are among the lay audience. They—and most of the rest of the population—do not have the expertise to reject the conclusions of the scientific community. They have rejected the results of the social scientists, perhaps because the results again seemed mysterious. With the physical evidence of brain development in the teen years and the effect of the environment on that development, some of the mystery is removed, and judges should recognize their own lack of omniscience and accept what scientists tell us about their fields of expertise.

C. Other Media Influences

Violence is the most studied area for social science effects and for evidence of physical effects on the brain, but there are other areas of concern. Perhaps the most prominent concern, even with a lack of scientific research in the field, should be the effects of hate speech. Hate speech is often the product of individuals, but it is also marketed and used as a tool by supremacist groups. The


\(^{252}\)See M.J. Keopp et al., *Evidence for Striatal Dopamine Release During a Video Game*, 393 NATURE 266 (1998).

\(^{253}\)Id.
Anti-Defamation League identifies an organization called Resistance Records as "a thinly disguised mouthpiece for the most dangerous organized hate group in America," the National Alliance.\textsuperscript{254} William Pierce formed the National Alliance and wrote \textit{The Turner Diaries}, a book about an attack on the federal government; Timothy McVeigh read the book before he bombed the Oklahoma City federal building.\textsuperscript{255} Resistance Records' catalog contains hundreds of titles of hate-filled music CDs by groups such as Nordic Thunder, Angry Aryans, Blue-Eyed Devils, and RaHoWa, a name derived from a contraction of "Racial Holy War."\textsuperscript{256} CD titles include \textit{Racially Motivated Violence, Holocaust 2000, Retribution, Born to Hate, and On the Attack}.\textsuperscript{257}

Combining hate speech with violent media, Resistance Records has also distributed the video game \textit{Ethnic Cleansing}.\textsuperscript{258} In that game, the player—who can be a skinhead or a member of the Ku Klux Klan—moves through the virtual streets of a city killing "subhumans," African-Americans and Hispanic-Americans. The goal is to reach the subway and search out and destroy the "Jewish masters" of the "subhumans," thwart their plans for world domination, and save the white race.\textsuperscript{259}

The aim of this hate-filled material seems to be the recruitment of a new generation of racists. According to the Anti-Defamation League, "Pierce believes hate music—with its racist, anti-Semitic and anti-government messages—can be used simply and effectively to attract troubled youths. His stated goal is to fill the ranks of the National Alliance with a new generation of haters."\textsuperscript{260} George Burdi, a RaHoWa member who founded Resistance Records, is quoted as saying, "[m]usic alone cannot save our Race, granted.... But our music is precious to us, and highly effective as a recruiting tool."\textsuperscript{261} The Anti-Defamation League quotes Pierce's explanation of the process by which hate music serves its stated goal:

\begin{quote}
As hate rock bands subtly infiltrate mainstream youth culture, they capitalize on teen-age rebelliousness and channel it into enmity and fury against "non-Aryans." Pierce has explained, "My aim with resistance
\end{quote}
music is to give them a rationale for alienation, to help them understand why they’re alienated, to help them understand the programs and policies behind these alienating conditions, and to give them a target, a purpose for their anger and rage.” Coupled with these organizations’ slick and enticing Web sites, hate rock is part of a multimedia approach that packs a powerful and seductive punch. Therein lies the most dangerous threat.262

Whatever disconnect there may be between judges or legislators and science, there appears to be no parallel disconnect in the racist world. Admittedly though, there does not seem to be a level of research for the effects of hate speech that matches the social science violence for violence in the media. Nonetheless, the impact of this sort of influence on the developing brain should be of concern and the subject of study.263

There is at least one brain study that speaks to some degree to this concern.264 The study employed functional magnetic resonance imaging (“MRI”) to examine the brain activity of a group of children and adolescents as they attempted to identify the affect portrayed by facial expressions.265 The expressions were all of fearful faces, but some participants incorrectly identified the faces as angry, confused, surprised, or happy.266 The functional MRI identified the region of the brain involved in the task and found it to be the amygdala, a portion of the limbic system “that evolved to detect danger and produce rapid protective responses without conscious participation” and “essential for the expression of autonomic and somatic fear responses.”267 The authors find it significant that the subjects did not correctly identify the facial expression consistently and conclude that their findings “suggest that one role of the amygdala during development may be to recognize facial expression and, through experience, learn to assign a label to facial expressions.”268

Given the hardwiring nature seen in brain development, influences that attach negative emotions to the appearance of faces of those of a different race or ethnicity may have a permanence that makes them particularly troubling. If this concern is borne out, it should justify limitation on the furnishing of racist

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263 There would be, of course, ethical concerns over such studies. While exposing children to violence to study effects seems to have been viewed as acceptable, hate speech, like sexual material, may raise more difficult ethical issues.


265 Ibid. at 195–97.

266 Ibid. at 198.

267 Ibid. at 195.

268 Ibid. at 198.
materials to minors and the imposition of speech codes in elementary and secondary schools that limit the exposure to these influences.

Another area that could be of concern—and at least demands study—is the effect of images in advertising. The blooming and paring of synapses results in hardwired connections between certain stimuli and reactions. If advertising manages to make such a connection between certain varieties of products, such as cigarettes or alcohol, and pleasant or exciting scenarios, the hard wired attraction of these products would become hard to resist. Again, this is an area that calls for study. As with hate speech, if science bears out the concern, courts should allow for the protection of the healthy psychological development of children by limiting exposure to the materials.

III. JUVENILE JUSTICE

There is a well-developed body of literature addressing the increasingly severe treatment faced by juvenile offenders and arguing that society should take their immaturity into account in responding to their transgressions.269 This Section will not attempt a full survey of that research, but will summarize some of the concerns and arguments. Somewhat more effort will be devoted to showing how the recent findings in neuroscience support the position that children are different and should be treated differently in the criminal process.

The treatment of juvenile offenders has varied greatly throughout the history of the United States. In the first century of the republic, the common law infancy defense controlled. Under that defense, children under age seven were legally incapable of criminality, those between ages seven and fourteen were rebuttably presumed to lack the capacity to establish the mental elements of a crime, and children over age fourteen were presumed to have sufficient mental capacity to be criminally liable.270 While the common law was protective of those under age seven, those between ages seven and fourteen—as well as older children—could face severe punishment. Professor Streib, in his work on juveniles and the death penalty, cites instances from the colonial era through modern times in which children were executed who were as young as ten at the time of their crimes.271 So while there may have been beneficial presumptions, those found guilty of crimes faced adult punishment.

The late nineteenth century saw a reform in the treatment of juveniles. The creation of separate juvenile courts around the turn of the twentieth century “was a product of the social reform movement of that period” and “reflected the late 19th century understanding of the nature of crime and a new recognition of

269 See articles cited infra notes 270–89.
psychological differences between youths and adults, which was emerging from
the ‘new’ science of psychology.\textsuperscript{272} The then-developing approach was to define
the offenses of children as acts of delinquency, rather than crimes.\textsuperscript{273} Juveniles
came to be seen as having “different competencies than adults (and therefore
needed to be adjudicated in a different type of venue)” and “different potential for
change than adults (and therefore merited a second chance and an attempt at
rehabilitation).”\textsuperscript{274} While this recognition of greater potential for rehabilitation
demanded sentencing aimed at treatment and mitigated against long determinate
sentences, states still executed persons who committed crimes as juveniles in each
of the first seven decades of the twentieth century.\textsuperscript{275} For example, a state
executed one defendant for a crime committed at age thirteen.\textsuperscript{276} Despite these
instances, it was clear that states reformed their treatment of juvenile offenders
and that they recognized children as being different from adults, as something
other than just miniature adults.

More recently, “reform” has been in the opposite direction. Over the past
thirty or so years, “judicial decisions, legislative amendments, and administrative
changes have transformed the juvenile court from a nominally rehabilitative social
welfare agency into a scaled-down, second class criminal court for young
people.”\textsuperscript{277} This seems to have been motivated by increasing crime rates among
the young and a loss of faith in rehabilitation even for that age group.\textsuperscript{278} Some
children have come to be seen as “predators” or even “superpredators,”\textsuperscript{279} rather
than persons in need of treatment, and there has been a movement to treat them
more severely than was the practice in juvenile courts. “Virtually every state has
lowered the age and expanded the offenses for which juveniles can be transferred
to criminal court, and those offenders who remain under juvenile court
jurisdiction may face harsher sentencing in some states . . . .”\textsuperscript{280} There are now

\begin{itemize}
\item \textsuperscript{272} Elizabeth S. Scott & Thomas Grisso, \textit{The Evolution of Adolescence: A Developmental
\item \textsuperscript{273} See Laurence Steinberg & Elizabeth Caffman, \textit{The Elephant in the Courtroom: A
\item \textsuperscript{274} \textit{Id.}
\item \textsuperscript{275} \textit{See Streib, supra} note 271, at 56 tbl.4.
\item \textsuperscript{276} \textit{See id.} at 93–94.
\item \textsuperscript{277} Barry C. Feld, \textit{Abolish the Juvenile Court: Youthfulness, Criminal Responsibility, and
Sentencing Policy}, 88 J. CRIM. L. & CRIMINOLOGY 68, 68 (1997). The content of the quote may seem
to be at odds with the title of the article, but Professor Feld’s position that juvenile courts should be
eliminated does not advocate adult punishment for children. Rather, he argues that differences
between children and adults may be taken into account in adult courts in the sentencing decision. \textit{Id.}
at 69.
\item \textsuperscript{278} Bazelon, \textit{supra} note 270, at 175; \textit{see also} Elizabeth Cauffman & Laurence Steinberg, \textit{The
Cognitive and Affective Influences on Adolescent Decision-Making}, 68 TEMP. L. REV. 1763, 1763–
64 (1995).
\item \textsuperscript{279} See Elizabeth Cauffman et al., \textit{Justice for Juveniles: New Perspectives on Adolescents’
\item \textsuperscript{280} \textit{Id.} at 404 (citation omitted).
\end{itemize}
twelve states in which children of any age can be transferred to adult court.\textsuperscript{281}

The result of these "reforms" includes preteens confined to adult, high-security prisons and children younger than the common law age of seven facing criminal liability.\textsuperscript{282} Indeed, until the Supreme Court's 1988 decision in \textit{Thompson v. Oklahoma},\textsuperscript{283} children younger than age sixteen at the time of their crimes could face the death penalty\textsuperscript{284} under laws that transferred all murder cases to adult criminal courts. Even after \textit{Thompson}, sixteen- and seventeen-year-olds faced the death penalty. The Court upheld the constitutionality of that policy in 1989 in \textit{Stanford v. Kentucky}\textsuperscript{285} but very recently reversed itself in \textit{Roper v. Simmons}.\textsuperscript{286} Before \textit{Roper}, almost half the states allowed the execution of minors,\textsuperscript{287} and "[a] study of former jurors found that 60.5\% would be willing to sentence a 10-year-old to death."\textsuperscript{288}

This increased severity of the treatment of juvenile offenders and the abandonment of the rehabilitative approach toward these youths has led to a body of literature in opposition to the developing direction of the law.\textsuperscript{289} The literature is generally based on recognition of psychological conclusions that children do not have the judgmental capacity of adults. It is consistent with the theories discussed above, which indicate a longer period of development in juveniles than had earlier been thought to exist.\textsuperscript{290} Indeed, the \textit{Thompson} plurality recognized this lack of development, limiting the imposition of the most severe punishment on children because they ""deserve less punishment because adolescents may have less capacity to control their conduct and to think in long-range terms than

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\item\textsuperscript{281}Taylor-Thompson, \textit{supra} note 270, at 143–44.
\item\textsuperscript{282}See Michelle India Baird & Mina B. Samuels, \textit{Justice for Youth: The Betrayal of Childhood in the United States}, 5 J.L. & POL’Y 177, 177–78 (1996).
\item\textsuperscript{283}487 U.S. 815 (1988).
\item\textsuperscript{284}Id. at 832.
\item\textsuperscript{285}492 U.S. 361, 380 (1989).
\item\textsuperscript{286}125 S. Ct. 1183, 1198 (2005) (holding that death penalty cannot be imposed upon juvenile offenders and abrogating \textit{Stanford} decision).
\item\textsuperscript{287}See Taylor-Thompson, \textit{supra} note 270, at 144 n.7.
\item\textsuperscript{288}Cauffman et al., \textit{supra} note 279, at 404 n.9 (citing Catherine A. Crosby et al., \textit{The Juvenile Death Penalty and the Eighth Amendment: An Empirical Investigation of Societal Consensus and Proportionality}, 10 LAW & HUM. BEHAV. 245, 254 (1995)).
\item\textsuperscript{289}See, e.g., Cauffman & Steinberg, \textit{supra} note 278, at 1764 (arguing that "distinctions must be drawn between younger and older adolescents"); Scott & Grisso, \textit{supra} note 272, at 138–41 (suggesting juvenile justice policy that is formulated in developmental framework); Robert E. Shepherd, Jr., \textit{Developmental Psychology and the Juvenile Justice Process}, 14 SPG-CRIM. JUST. 42, 43–44 (1999) (arguing that lawyers and judges should be "sensitive to the developmental stage of the child"); Steinberg & Cauffman, \textit{supra} note 273, at 390 (arguing that adolescent development should be considered when adjudicating young offenders as adults); Taylor-Thompson, \textit{supra} note 270 at 145 (proposing juvenile system that "acknowledges rather than ignores the contributions made by developmental research"). Barry Feld also argues that differences in judgmental capacity should serve as mitigating factors for juvenile sentencing, though he argues against the existence of separate juvenile courts. See Feld, \textit{supra} note 277, at 69.
\item\textsuperscript{290}See \textit{supra} Part I.B.2.
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adults.” 291 Or, as explained by Professors Steinberg and Cauffman, “we cannot claim that adolescents ‘ought to know better’ if, in fact, the evidence indicates that they do not know better, or, more accurately, cannot know better, because they lack the abilities needed to exercise mature judgment.” 292

Cauffman and Steinberg, in an earlier effort, examined the research on the decision-making maturity of adolescents. 293 They found that adolescents, when compared to adults, “appear to view long-term consequences as less important than short-term consequences, and may thus see many risks . . . as inconsequential.” 294 They saw this as due, at least in part, to adolescent uncertainty about the future, which leads to a discounting of the severity of risks. 295 They also noted that during adolescent years, youths seek more novel and intense sensations and social status among peers becomes a more important factor in decision making. 296

Cauffman and Steinberg offered a theoretical framework for the examination of empirical evidence on adolescent decision making. They saw decision-making maturity as consisting of three components—responsibility, perspective, and temperance—and proceeded to analyze each. 297 They broke down responsibility further, into a number of subcomponents. The first was autonomy and independence; they found, in that regard, evidence that the capacity for self-direction increases in the adolescent years, with gains through the end of high school. 298 The second was identity, the degree to which individuals are aware of and confident in their own strengths and weaknesses, values and priorities. 299 They concluded that “[t]o the extent . . . that maturity of judgment goes hand in hand with consolidation of a sense of identity, research . . . suggests that most individuals would not be expected to display consistently mature judgment until the age of eighteen, at the earliest.” 300 They found an indirect link between an extended period of identity development and attainment of decisional maturity.

To the extent that research on self-esteem indicates that a full consolidation of the self-image does not occur until the last few years of the adolescent decade, we may cautiously conclude that late adolescence may be a time of important gains in maturity of judgment. . . [I]t seems clear that older adolescents (ages sixteen through nineteen) have a more mature sense of self than do younger ones. However, it seems additionally clear that gains in self-esteem and identity

291 Thompson, 487 U.S. at 834 (quoting Eddings v. Oklahoma, 455 U.S. 104, 115 n.11 (1982)).
292 Steinberg & Cauffman, supra note 273, at 404.
293 See Cauffman & Steinberg, supra note 278, at 1765.
294 Id. at 1773.
295 See id.
296 See id.
297 Id. at 1774.
298 See id. at 1775.
299 See id. at 1776.
300 Id. at 1776–77.
consolidation continue during the transition into one’s twenties.\textsuperscript{301}

Lastly, with regard to the components of responsibility, they examined the evidence on ego development. They found it reasonable to hypothesize that higher levels of ego development, a process that appears to take place in the twelve to sixteen age span, will be accompanied by greater maturity of judgment.\textsuperscript{302} Summing up the development of responsibility, they found numerous studies showing the development of responsibility in middle adolescence.\textsuperscript{303} However, they noted a lack of studies on the possibility that the development of responsibility might continue into the post high-school years.\textsuperscript{304}

Turning to temperance, Cauffman and Steinberg found that “[m]ost research indicates no reliable age differences in impulsivity among individuals between the ages of four and sixteen.”\textsuperscript{305} Thus, while other aspects of judgmental maturity have developed to a significant extent—perhaps completely—by age sixteen, the sixteen-year-old seems to be in the same boat as the four-year-old with regard to temperance versus impulsivity. While they noted that “a paucity of developmental research” in that area suggests that conclusion should be viewed with caution, they also found studies that “suggest that impulsivity may be stable during childhood and middle adolescence (until age sixteen), increase between middle and late adolescence (until age nineteen), and then decline over the course of adulthood.”\textsuperscript{306} This ties into the commonly recognized moodiness of adolescence.

It is widely believed that, owing both to greater stress and fluctuating hormones, adolescents experience emotional states that are more extreme, more variable, and less predictable than those experienced by children or adults. . . . Existing studies suggest that moodiness, or, more accurately, volatility of mood, may in fact be more characteristic of adolescents than adults.\textsuperscript{307}

Turning lastly to perspective, Cauffman and Steinberg again found development in this area during the period of adolescence. They found that egocentrism declines from childhood through middle adolescence (by which they mean age sixteen), when the process is complete.\textsuperscript{308} They did note, however, that some studies indicate a peak in egocentrism in early adolescence.\textsuperscript{309} With regard to social-perspective taking, where “the individual understands that the

\textsuperscript{301} Id. at 1778.
\textsuperscript{302} See id. at 1779.
\textsuperscript{303} Id. at 1780.
\textsuperscript{304} Id.
\textsuperscript{305} Id. (citation omitted).
\textsuperscript{306} Id. at 1781.
\textsuperscript{307} Id. at 1782.
\textsuperscript{308} See id. at 1784–85.
\textsuperscript{309} See id.
perspectives people have on each other are complicated and influenced by larger forces than individuals can control, including social institutions and social roles,” the development appears to be one of late adolescence.\textsuperscript{310} Furthermore, “future-time perspective,” the ability to project events into the future—an ability necessary to take into account long term consequences—increases both between childhood and adolescence and between adolescence and young adulthood, the development continuing at least through the last year of college.\textsuperscript{311}

Another examination of the development of judgmental ability is presented by Professors Scott and Grisso.\textsuperscript{312} They argue that factors in psychosocial development such as conformity to peers, perception of risk, and temporal perspective influence the ability of adolescents to make judgments in ways that speak to criminal culpability.\textsuperscript{313} The authors note that the pressure to conform to peers peaks at about age fourteen.\textsuperscript{314} They also note that the greater inclination of adolescents to take risks may arise out of a lesser awareness of risks, a difference in assessing the probabilities behind risks or differing values attached to the outcomes, with peer pressure and ostracism coming back in to play a role in the cost-benefit analysis.\textsuperscript{315} As to temporality, compared to adults, adolescents weigh short-term benefits or consequences more heavily than long-term benefits, which leads to taking long-term risks to gain short-term benefits.\textsuperscript{316} The authors suggest that this may be the result of both uncertainty about the future and different perceptions of time spans.\textsuperscript{317}

[A]dolescents may use information differently from adults. They may consider different or fewer options in thinking about their available choices or in identifying consequences when comparing alternatives. . . . [W]hile older adolescents may have adult-like capacities for reasoning, they may not deploy those capacities as uniformly across different problem-solving situations as do adults, and they may do so less dependably in ambiguous or stressful situations. . . . [A]dolescents may weigh costs and benefits differently (or view as a benefit what adults would count as a cost).\textsuperscript{318}

Furthermore, they argue that the fact that delinquent behavior decreases in late adolescence indicates that these factors are not just individual behavior traits but are instead a part of the development of children through adolescence and into

\textsuperscript{310}Id. at 1785.
\textsuperscript{311}Id. at 1786–87.
\textsuperscript{312}See Scott & Grisso, supra note 272.
\textsuperscript{313}Id. at 160–61.
\textsuperscript{314}Id. at 162.
\textsuperscript{315}Id. at 163.
\textsuperscript{316}Id. at 164.
\textsuperscript{317}Id.
\textsuperscript{318}Id. at 164–65 (citations omitted).
adulthood.\textsuperscript{319} Not surprisingly, these scholars argue for changes in juvenile justice, though it should be noted that the authors suggest that more research is needed. In their earlier article, Cauffman and Steinberg state, "[o]ur impression is that if the theoretical links between psychosocial characteristics and maturity of judgment can be experimentally validated, one might justify a general distinction between adolescents sixteen and younger and those seventeen and older."\textsuperscript{320} In their later article, they argue the need for those debating and implementing juvenile justice policy to take the developing social science research into account.\textsuperscript{321} And they suggest that society recognize three categories: juveniles who should only be adjudicated in juvenile court, adults, and a middle category of youths "who may or may not be developmentally appropriate candidates for adult trial and sanctioning, depending on their characteristics and circumstances."\textsuperscript{322} Among those characteristics and circumstances appear to be the juvenile's maturity, as a factor speaking to culpability.\textsuperscript{323} This, and the individual's amenability to treatment,\textsuperscript{324} can be used as a way to find a balance between the longer term incarceration an adult might face and the rehabilitative ideal that was historically a part of juvenile justice.

Scott and Grisso also find guidance for juvenile justice policy in the social science.\textsuperscript{325} They again note that the desistence of delinquent juvenile behavior as adolescents approach adulthood indicates that their criminal conduct, at least for most youths, is the result of adolescent psychological development.\textsuperscript{326} This they say should serve to reduce culpability for youthful offenders.

If youthful choices to offend are based on diminished ability to make decisions, or if the choices (or the values that shape the choices) are strongly driven by transient developmental influences, then the presumption of free will and rational choice is weakened. Psychology, in providing evidence that developmental psychosocial factors may shape decision-making well into adolescence, lends support to the intuitive conclusion that immature offenders are less culpable than their adult counterparts.\textsuperscript{327} They note that this psychological evidence speaks particularly to any retributive justification for the imposition of sanctions, to the do-the-adult-crime-do-the-
adult-time approach.

A claim that juvenile offenders deserve equivalent punishment to that imposed on adults presumes that no substantial differences exist that undermine the legitimacy of imposing equal measures of retribution on the two groups. On this point, the evidence disputes the conclusion that most delinquents are indistinguishable from adults in any way that is relevant to culpability.328

They do suggest that courts try to distinguish between individuals whose criminality is tied or limited to adolescence and those for whom delinquency/criminality is part of a persistent, lifelong pattern.329 While this determination may be difficult to make in any particular case, the effort is worth taking. The social costs of incarcerating for life, or even for a long term, an individual who would soon outgrow his or her delinquency, is a waste of that life. That does not mean that those who commit offenses as juveniles should simply be left to their development, but it does speak for intervention and rehabilitation, rather than simple incarceration or some form of retribution, and the authors offer suggestions for society's response to these juvenile offenders.330

The conclusions of these psychological examinations of, and prescriptions for, juvenile justice are certainly consistent with the earlier examinations of moral development.331 Both groups of studies indicate a development of morality and judgment that is far from complete in the early teen years, that continues into the middle teens and perhaps on into the early twenties. This raises the question of why politicians and the public have not concluded that it is unreasonable to treat juvenile offenders the same as adults who commit similar acts. Some of that failing may be because of the terrible consequences of some youth delinquency/crime, and indeed, there may be a need to incarcerate dangerous minors.332 But some of the refusal to recognize the differences between adults and children or adolescents may be the result of the same sort of skepticism of psychological research as that which has made judges unwilling to accept the psychological evidence on media and violence. If it is skepticism regarding psychological research, the physical nature of neuroscience research may help overcome doubts and provide sufficient support for those arguing for a change in the treatment of juvenile offenders to convince the public and political leaders.

The conclusions in neuroscience indicate a finding matching that in the psychological studies. "[N]euroscientists are starting to pinpoint what the pruning process accomplishes in the developing teenage brain. . . . [T]hey know that it's connected to the fine-tuning of important brain functions, including inhibition

328 Id. at 174.
329 See id. at 177.
330 See id. at 182–89.
331 See supra Part I.A.
332 See supra notes 329–30 and accompanying text.
control and working memory, or the ability to hold information in your head when there is competing information. This is a difference that speaks not only to some juveniles making the wrong choices, but to all juveniles. Up through at least middle adolescence, they are under a disability when it comes to making the judgments on which criminal liability can depend.

The brain is working constantly, and one of the tasks it works at is to inhibit itself from a variety of actions. . . . As the brain develops—in children and, as science is now learning, in teenagers—it is this very inhibition machinery that is being fine-tuned. . . . [W]hat can we expect of adolescents if that inhibition machinery, the prefrontal cortex, is not yet fully tuned?

What the criminal law demands of all of us is that we inhibit ourselves and not perform some acts that we may see as pleasurable or otherwise attractive. Some of us are more easily inhibited than others, and we punish the failings of those who are not limited by adequate inhibitions. But where a juvenile has not reached the stage at which this inhibitory mechanism has developed, the act is less a sign of personal failure and more a sign of youthful inability.

All this is not to say that society should simply stand aside, tolerate all acts by juveniles, and wait for delinquents to become adults. It does, however, point to the direction that juvenile justice should take. The psychological conclusions regarding the inappropriateness of retribution-motivated sanctions seem particularly apt. If juveniles are in some way incapable of making mature judgments, a societal desire to take revenge is unreasonable. It makes no more sense to express strong moral outrage over a juvenile making a faulty judgment at a stage at which such an ability is not yet developed than to be angry over a four-year-old's inability to solve quadratic equations, despite being shown how to do the task.

There will still be a need to incapacitate some juvenile offenders. It is beyond question that children are capable of performing acts that cause great harm. Society needs to prevent those harms and may choose to do so through incarceration or some other form of strict supervision. There should be recognition, however, that the juvenile who must be incarcerated may proceed in his or her development to the point where incapacitation is no longer required. While we may feel confident in concluding that a particular adult will always be a danger, that conclusion seems far less reasonable regarding an adolescent in the process of judgmental and moral development. That is not to say that a system in which juvenile offenders are held only until they become adults is the wisest choice; some juveniles will remain dangerous as adults. What is called for is an individual determination that is in direct conflict with the imposition, or at least

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333 Strauch, supra note 78, at 65.
334 Id. at 32.
the automatic imposition, of long prison terms. Rather than the adult sentencing model, a model based on commitment for mental reasons might be the better guide, with a juvenile being released upon reaching the point where he or she is no longer a danger to self or society.

The hallmark of juvenile justice should be the rehabilitative ideal that has seemingly been lost from the adult system. If juveniles are still in the process of development in judgmental ability and moral reasoning, the response to a faulty exercise of those less-developed capacities should be help in guiding the process. Some may need more guidance and direct intervention than others, but the emphasis must be on helping the juvenile develop into a responsible adult. Youths are still pliable to a degree that adults may not be, and that pliability should be taken into account in the way we treat juvenile offenders. The possibility of change and release must guide the juvenile justice system.

IV. CONCLUSION

It would not be surprising to find most readers agreeing with half of the arguments presented herein. Liberals will agree that society is too harsh in its treatment of juvenile offenders. They will note the immaturity of children and their amenability to treatment. This plasticity justifies leaving open the possibility of rehabilitation and counsels against the death penalty, life imprisonment without the possibility of parole, or even long-term determinate sentencing. On the other hand, liberals are likely to disagree that the media influences children face should be restricted.

Conservatives are less likely to negatively receive the suggested limitations on children’s exposure to violent video games or other potentially harmful media influences. But they are also likely to disagree with arguments for more lenient treatment of juveniles. Seeing juveniles as just as dangerous and just as culpable as adult offenders, they may well argue for a do-the-adult-crime-do-the-adult-time approach to juvenile justice.

What must be recognized is that these two issues are just opposite sides of the same coin. If children are already set in their ways and have completed their development, then liberals may be right on the media issue and conservatives on the juvenile justice issue. If instead, as modern neuroscience is finding, children are in the process of physical development in the judgmental areas of the brain, then the areas in which the two sides are correct turn around: liberals are wrong in arguing that children should have open access to material that is in fact

335 There is also a deterrent aspect to punishment. A deterrence rationale would seem to rely on the assumption that people make rational determinations in the process of making judgments. If that capacity is lacking in juveniles, deterrence may not work in the way indicated. Deterrence is, of course, also a part of the feedback that affects the development of moral reasoning and judgmental ability. So discipline that teaches may be justified, while punishment that is simply the infliction of penalties in hope that potential displeasure will deter seems less justified for those not capable of making such reasoned cost-benefit analyses.
detrimental to their development as psychologically healthy adults, and conservatives are wrong in arguing that children who commit adult crimes are as incorrigible as adult offenders and should face the same punishment. Neuroscience demonstrates that adolescents are at a plastic stage of brain development that requires protection and that should be taken into account in responding to instances of bad decision-making.

It sometimes takes scientists an extended time to change the underlying paradigm that guides and explains their research, and major change sometimes comes about only after those trained in older views die off.\textsuperscript{336} The recent findings in neuroscience are not the major sort of revolution that would require psychologists to change their paradigm. In fact, the findings support the views of social scientists and psychologists. The paradigm that needs to change is that which undergirds the scientific model held by judges and legislators. The neuroscience findings can help further that change by providing a physical explanation for the statistic-based conclusions in social science. With that physical basis, it may be that legal and political conclusions can change, without waiting for judges and legislators to die off or retire. If not, the costs may well be lives, the psychological health of young people who continue to be exposed to dangerous media influences, and the wasted lives of juveniles convicted of criminal behavior and jailed for far longer periods than would be necessary for the protection of society.

\textsuperscript{336}\textit{See generally} Thomas S. Kuhn, \textit{The Structure of Scientific Revolutions} (3d ed. 1996) (evaluating how paradigm shifts occur in science, concluding that theories incompatible with current paradigm create crisis that eventually leads to change of entire perspective, and determining that scientific community often does not accept new paradigms immediately).