

COMMONWEALTH OF KENTUCKY VS. EFRAIN DIAZ, JR.
15-CR-0584-001

BUFKIN

DEFENSE EXPERT WITNESS TESTIMONY

JUDGE (J): HON. ERNESTO SCORSONE

PROSECUTION (P): HON. LOU ANN RED CORN

PROSECUTION 2 (P2): HON. ANDREA MATTINGLY WILLIAMS

DEFENSE (D): HON. MICHAEL BUFKIN

DEFENSE 2 (D2): HON. KIM GREEN

WITNESS (W): LAURENCE STEINBERG

1 J: Well alright. Defendants present with counsel. Commonwealth present. Is the
2 Commonwealth ready?
3
4 P: Uh it's the defendant's motion.
5
6 J: Yeah I know but I mean are you ready?
7
8 P: Oh yes oh we're...
9
10 J: Okay.
11
12 P: ready.
13
14 J: Defense ready?
15
16 D: Yes your Honor.
17
18 J: Alright...
19
20 D2: Yes...
21
22 J: You all had uh asked uh to allow the introduction of some testimony...
23
24 D: Yes your Honor.
25
26 J: I'm in support of your motion on the constitutionality of the statute. So ready to
27 begin?

Commonwealth v. Efrain Diaz, Jr.

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Defense Expert Witness Testimony Steinberg

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1 D: If it may please the Court...
2
3 J: Yes.
4
5 D: uh I would call Professor Laurence Steinberg to the stand...
6
7 J: Alright.
8
9 D: please. (PAUSE)
10
11 J: Alright if you'll stand right here sir and raise your right hand. (WITNESS BEING
12 SWORN) Thank you please come around to this chair right here. (PAUSE)
13 Alright. If you would for the record give us your full name.
14
15 W: Laurence Steinberg.
16
17 J: Thank you counsel your witness.
18
19 D: Thank you very much your Honor. Professor can you please tell Judge Scorsone
20 your education please?
21
22 W: Yes. I received my Bachelor's Degree in Psychology from Vassar College in
23 nineteen seventy-four (1974). I have a PhD in Developmental Psychology from
24 Cornell University in nineteen seventy-seven (1977).
25
26 D: And can you tell us a little bit about your qualifications please?
27
28 W: Yes. My training is in Developmental Psychology which is the study of how
29 people grow and change as they age. My specialty is in adolescent development
30 and I have been engaged in research on adolescent development for the past
31 forty years or so. After I finished my doctoral work at Cornell I took a position at
32 the University of California in Irvine uh following that I was on the faculty at
33 University of Wisconsin in Madison and in nineteen eighty-eight (1988) I moved
34 to Temple University in Philadelphia where I have been on the faculty since then.
35
36 D: Very good. And um, what is your primary field of study?
37
38 W: My primary field of study is Adolescent Development and most recently
39 specifically Adolescent Decision Making and Risk Taking and in the Application of
40 the Science of Adolescent Psychological and Brain Development to Legal and
41 Policy Issues.

1 D: Okay. Well we want to I want to start right off by defining one of the terms that
2 we're using already and that is the term adolescent. Can you please define that
3 for us?
4
5 W: Sure. Um, people define adolescence in many different ways. For my purposes
6 and for the purposes of my testimony today I am thinking of adolescence as the
7 period from ten until um twenty in other words from ten to up to twenty-one.
8
9 D: Okay thank you. Um, and have you been qualified as an expert before by
10 courts?
11
12 W: Yes I have.
13
14 D: And could you tell us uh a little bit about which courts that have done that?
15
16 W: I've been qualified by experts in state courts in New York and Wisconsin and
17 Colorado and Pennsylvania. And I've been qualified by federal courts um in the
18 districts in New York and uh the state of Washington.
19
20 D: Thank you very much. Um, let's get right to the heart of the matter. Uh could
21 you please tell us when does the brain mature?
22
23 W: The brain matures over an extended period of time. And certainly beginning
24 from birth the brain is, maturing. If by your question you're asking when does
25 the brain finish maturing...
26
27 D: Yes...
28
29 W: um the answer would be to the best of our understanding sometime during the
30 mid-twenties. I say that sometime during the mid-twenties because different
31 parts of the brain mature along different timetables. Some aspects of brain
32 development are more or less complete by the time individuals are in their mid-
33 teens but other aspects of brain development are not complete until individuals
34 are let's twenty-three or twenty-four years old.
35
36 D: Okay. And how is it that we know this where where does this information come
37 from?
38
39 W: Well uh up until the late nineteen nineties (1990's) we didn't really know very
40 much about adolescent brain development and when I was in graduate school in
41 the nineteen seventies (1970's) it was commonly believed that the brain stopped

1 developing at around the age of ten or so. And that was because the brain
2 reaches its adult size at that age. It wasn't until the advent of imaging
3 technology during the nineteen nineties (1990's) primarily that scientists became
4 able to look inside the living brain. We could always do autopsies of course but it
5 wasn't until then that scientists could look inside the living brain and see how the
6 anatomy of the brain and the functioning of the brain changed with age. The
7 first, published studies of adolescent adolescent brain development appeared in
8 nineteen ninety-nine (1999) two thousand (2000) around then so it wasn't until
9 as recently as that that we understood that there still was tremendous change
10 going on inside the brain during adolescence. But at that time point scientists
11 had not eh expressed any interest in asking this question for people who are
12 older than eighteen. Um and and at the time when *Roper* was heard *Roper* was
13 decided in two thousand and five (2005) there really wasn't much research on
14 brain development that went beyond the age of eighteen. Uh that after all of
15 that was the question in *Roper* anyway so it didn't matter. But during the period
16 from about two thousand and five (2005) until today, the age range that
17 scientists have focused in their studies of brain development has expanded. And
18 in the last ten years or so we have seen that a lot of the maturation uh takes
19 places between ages ten and eighteen is actually ongoing into their early
20 twenties up until we think the the mid-twenties. So it hadn't been known at the
21 time of *Roper* that there was this brain maturation that extended past eighteen
22 but that is now well established in the scientific literature.

23
24 D: Okay. Um and if you would tell us the difference, or difference as uh between an
25 immature adolescent brain and a mature adult brain and by that I'm talking in
26 two terms one is structurally and one is functionally uh as the literature talks
27 about. If you could address that issue?

28
29 W: Sure. Um the kind of maturity that we have been talking about in the legal cases
30 that have been discussed um has to do primarily with um the ability of the
31 individual to control his impulses, as to regulate his behavior. Um the ability of
32 the individual to have a more accurate perception of risk. Um and the uh the
33 extent to which the person's emotions are easily aroused. So what we see
34 happening as people mature through adolescence and from adolescence into
35 adulthood is that, they get better at perceiving risk where it is there. They get
36 better at controlling their impulses. And they get better uh at at controlling
37 themselves in emotionally arousing situations. Another aspect of brain
38 development that I do want to explain here has to do with the capacity of the
39 brain to change. So as many of you probably know, the brain is a malleable
40 organ it changes in response to experience that's how we learn things. Um
41 neuroscientist talk about a characteristic of the brain called plasticity. Which is

1 the extent to which the brain can be changed by experience. The brain is more
2 plastic during adolescence than it is during adulthood. Which means that people
3 are more capable of changing during adolescence when the brain is more plastic
4 than they are during adulthood. That was an important part of the reasoning um
5 it has been courts' decisions in *Graham* and *Miller* in which they talked about the
6 heightened capacity of younger people to change in response to rehabilitation.
7

8 D: Okay. Um, and I just want to uh ask you this for clarification before we get too
9 far into this. Um, this is all information that has been gathered by scientists
10 through study through tests through observation and through scientific means is
11 that correct?
12

13 W: That's correct. Gathered by scientists and, um published in peer reviewed
14 scientific journals so gathered by scientists and also evaluated by scientists. And
15 the research for the most part has been funded by the federal government by
16 the National Institutes of Health.
17

18 D: Um, I have sort of a two-part question here. Um, how does the immaturity of
19 the adolescent brain manifest itself and isn't that simple a function of
20 intelligence? Isn't that what a lot of people would kind of jump to?
21

22 W: Well compared to adults, adolescents are more impetuous. Um the eh because
23 they have more difficulty regulating their emotions they're more susceptible to
24 peer pressure and the influence of of peers. Um, they are less able and less
25 likely to think about the future consequences of their actions. They're less likely
26 to be able to make longer term plans. They're more focused on the immediate
27 consequences of a decision rather than the longer-term consequences of the
28 decision and they tend to be more focused on, the potential rewards of a risky
29 choice rather than the potential costs of a risky choice. Um so if they're thinking
30 about let's say speeding down the highway what's on their mind is how fun it's
31 gonna feel to be driving the car that fast and what typically would not be on their
32 mind is the chance that they might hurt somebody or get a speeding ticket. Um
33 this is different from intelligence in that when when we think about intelligence
34 we tend to think about the purely cognitive aspects of functioning. Things like
35 memory, um and attention and perception. And we also might think about facts
36 that we have um uh held in in memory so that might be referred to as general
37 intelligence. The factors that I'm talking about are usually described by
38 psychologists as having to do with judgment. And not with intelligence per say.
39 And I think one of the things that perplexes a lot of parents for example is that
40 even though they see their teenage children as smart and even though their
41 children can do things in school that seem like things you would have to be

1 intelligent to be able to do they nevertheless do a lot of reckless and dumb
2 things. And that's because adolescence is a time when people can be very
3 intelligent but have very poor judgement.
4

5 D: Okay. Let's ask about a comparison that I'd like you to kind of uh take a stab at
6 it. Um, does a twenty-year-old brain more closely resemble a seventeen-year-old
7 brain than a mature say twenty-five-year-old brain?
8

9 W: Well that's hard to answer. Um because brain development is gradual and linear.
10 Um it's not a switch that gets flipped when it changes from a immature brain to a
11 mature brain. Um it is like a a seventeen-year-old brain was that the age you
12 asked me to compare it...
13

14 D: Yes...
15

16 W: to? It's like a seventeen-year-old brain in the sense that it is still growing and
17 changing um and it is still malleable and plastic. Um it is uh it it is a little bit
18 more mature than a seventeen-year-old brain but it is maturing and in that sense
19 it is different from an adult brain.
20

21 D: Okay if you would, speaking you know kind of eh in the the physical world and in
22 terms of biologically etcetera, um are there significant differences between the
23 brain of a twenty-year-old and a mature brain?
24

25 W: Well...
26

27 D: And in what ways?
28

29 W: sure. Um, so there there is a process inside the brain that's called the
30 myelination. Myelination is the process through which the circuits of the brain
31 that is the wiring of the brain if you will um becomes insheathed in a white fatty
32 substance called myelin. Myelin, serves a purpose in the brain that's very much
33 like the insulin uh the insulation around the speaker wires you might have in a
34 stereo system. And in the same way that that plastic insulation allows the
35 electricity to flow through the speaker wire without breaks in it without um
36 interruption um without leakage. The myelin in the brain um allows electrical
37 impulses to travel down those neurocircuits without breakage and without
38 interruption and more um, smoothly and con more quickly. M myelin therefore
39 allows for better connections between different regions of the brain because it
40 allows those electrical impulses to travel longer distances throughout the brain
41 um without leakage and without interruption. So one of the things that scientists

1 have been interested has to do with the connections between the the rational
2 part of the brain which is in the prefrontal cortex. The front of the brain. And
3 the more emotional part of the brain which is in the limbic system which is
4 deeper inside toward the center of the brain. And because connections between
5 those two regions are becoming more myelinated, they're becoming better
6 connected during the adolescent years and their early twenties. Communication
7 between those regions those rational regions and the emotional regions becomes
8 improved. And that's what we think leads to the heightened capacity of of
9 individuals as they get older to control their impulses and and regulate their
10 emotions.

11
12 D: Okay very good. Um, you were involved in the preparation of uh, uh amicus
13 curiae briefs in uh *Miller v. Alabama*, *Graham v. Florida* and *Roper v. Simmons* is
14 that correct?

15
16 W: Yes.

17
18 D: Can you tell us a little bit about what your involvement was...

19
20 W: Yes...

21
22 D: in those cases?

23
24 W: Um in before *Roper* I was a member of a joint committee of the American
25 Psychological Association and the American Bar Association. And as it appeared
26 that the Supreme Court was going to take *Roper*, the American Psychological
27 Association decided to file an amicus brief um in that case. And the general
28 counsel of the association came to me and asked if I would lead the team of
29 scientists who would help make sure that the amicus brief draft was scientifically
30 accurate. So I had nothing to do with the crafting of the legal arguments...

31
32 D: Right.

33
34 W: in the brief but my role was to assemble the science on adolescent psychological
35 development and adolescent brain development. Give it to the attorneys who
36 were writing the brief. Make sure that they described the science accurately and
37 then read and go back and forth uh eh you know over the drafts to make sure
38 that what was being said in that brief was scientifically true. And I played the
39 same role in *Roper* and *Graham* and *Miller*. So also the case that some of the
40 work that I had written independent of that was cited by the Supreme Court in
41 those three cases. When the court reached its conclusion that the juvenile death

1 penalty was unconstitutional that um imposing life without parole on juveniles for
2 non-homicide crimes was unconstitutional and that mandating life without parole
3 for juveniles for any crime was unconstitutional.
4

5 D: Okay. Um and when you say you lead a team, there were uh a number of other
6 scientists working with you on this project?
7

8 W: About a half a dozen.
9

10 D: About a half a dozen okay. Um, and um, in *Roper* uh Justice Kennedy opined
11 that there were three things that applied to twenty-year old's can you tell us
12 what those are were?
13

14 W: Well he opined that they applied they apply to people who were um younger
15 than eighteen in...
16

17 D: Okay...
18

19 W: in *Roper*. Um, because the case there was not about twenty-year old's.
20

21 D: Okay.
22

23 W: He he um noted three characteristics that distinguish adolescence from adults.
24 They are impetuosity. That is the extent to which they make impulsive decisions.
25 Their susceptibility to um to coercive influence especially of peers. Um, and the
26 fact that their character is not yet fully formed. And those were the three
27 defining characteristics of young people that Kennedy said should make them not
28 eligible for the punishments that we reserve for the the harshest of of of crimes
29 committed by people who are fully responsible for their behavior.
30

31 D: And based upon your studies uh do those characteristics apply to a twenty-year-
32 old?
33

34 W: Ye yes they do.
35

36 D: Okay. Okay um, so time has passed since then uh uh *Roper* was decided in two
37 thousand and five (2005) uh, has the study of the adolescent brain an advan
38 advance since then and if so in what ways?
39

40 W: Well it's advanced tremendously since then remember as I said before that it
41 didn't really begin until about two thousand (2000). Um so, eh as two thousand

1 five (2005) today let's see we're talking about a little more than ten years but
2 there are literally thousands more studies of adolescent brain development that
3 have in in the public published literature. There are multiple journals scientific
4 journals that are devoted exclusively to the study of adolescent brain
5 development. Books on the topic as well so the science has really expanded.
6 We know much much more about eh about what's going on inside the adolescent
7 brain both anatomically and functionally. We know much much more about the
8 timetable of different aspects of brain maturation and as I said before one of the
9 important lessons that we've learned in the last ten years is that the maturation
10 that is taking place during the teen years continues to take place as people move
11 into their early and towards their mid-twenties. Um and uh at the same time
12 that that research has been done uh eh it's also important I think to note that
13 there's been a lot of psychological research on development during this time
14 period as well. Uh my own research has focused on the development of things
15 like impulse control and sense and risk perception. And uh response to reward
16 and susceptibility to peer influence. And in our studies of young people both in
17 the United States and around the world we have found that the psychological
18 capacities that are thought to be influenced by this brain development are also
19 maturing during this time too so it's not just the fact that the brain is developing
20 it's that people are getting better at this age at controlling their impulses at
21 resisting peer pressure, at thinking ahead. And understanding wh where risk is
22 and what the consequences of risky decision might be.

23
24 D: Okay. Um, how has the advent of functional magnetic resonance imaging
25 advanced the study of the adolescent brain and you might want to just explain
26 what the FMRI is?

27
28 W: Well the MRI is a brain imaging um well technique um which allows scientists to
29 see what parts of the brain are active and how active they are um when
30 individuals are doing different things. And so, um before the advent of functional
31 magnetic imaging um wh we eh eh wh what we knew about the brain was by eh
32 was through observation of of the brain e either from the outside or in an
33 autopsy from the inside. Um or in animal studies from the inside as well. With
34 the advent of brain imaging techniques we can take you, and put you inside a a
35 machine which we call a scanner um and in that machine we would have um a
36 computer screen that you could see and we could ask you to do different things
37 to read something to listen to a passage of music, to make a decision by using
38 your fingers to press the spacebar on the computer keyboard. And we would be
39 able to tell by looking at a monitor that was that was tracking your brain activity
40 how your brain activity changed as a function of what you were doing in there.
41 We can do that because when the brain is active there is a flow of blood to that

1 region of the brain and the MRI technique is um is designed to be able to see
2 where there are changes in blood flow to the brain depending upon what
3 somebody is doing. So we might compare what your brain looks like when
4 you're reading something versus when you're listening to something. And that
5 might get us eh to better understand well what parts of the brain are intri are are
6 important for visual processing of words as opposed to auditory processing of
7 words. And what parts are common because in both of those tasks you're
8 processing words in one way or another.

9
10 D: And has that informed the uh information regarding the maturity of the brain
11 over time?

12
13 W: Yes because a lot of the maturation of the brain particularly during adolescence
14 um and during the early adult years, a lot of that maturation is only visible by
15 looking at the brain activity. In other words su se for for in many instances if
16 you just looked at the structure of the brain of the anatomy of the brain you
17 wouldn't see differences between adolescents and adults. But if you put those
18 individuals into um a scanner and you give them the same tasks you might see a
19 different pattern of activity in a younger person than you would in an older
20 person. So fMRI has enabled us identify differences between the adolescent
21 brain and the adult brain that we could never have seen had it not for that
22 imaging technique.

23
24 D: Okay. Excellent. Um, I'm gonna ask for you to make a a comparison and
25 compare the um how do young adults age twenty do in controlling impulses
26 when they are aroused by something negative?

27
28 W: Um, they don't do as well as they do when they're not aroused and they don't do
29 as well as adults do um when they are aroused. So let me let me describe a
30 study that our group did which...

31
32 D: Okay...

33
34 W: illustrates this point. Um we had a a task it was a standard psychological task
35 um in which you are looking at a screen and you're asked to press a button every
36 time you see a certain letter. Let's say it's the letter X. And you're asked to not
37 press the screen if you see a different letter. And now we show you a series of
38 letters that are going along pretty quickly in front of you and we mix in, X's and
39 non-X's but we have a lot of X's so you get very accustomed to pressing the
40 button because you're seeing a lot of X's and then all of a sudden they'll be a D
41 in there and you're supposed to withhold that press. It's hard to do. Because

1 we get you accustomed to pressing and then we throw in something that you're
2 not supposed to press to. We did a study in which we looked at teenagers let's
3 say around the age of fifteen or so um people between eighteen and twenty-one
4 and people who were uh twenty-four and and a little bit older. And we gave
5 them that task while they were in a scanner. Um but we altered the emotional
6 context of the experiments so that sometimes you were asked to do this task
7 under emotionally neutral conditions and sometimes you were asked to this task
8 under emotionally arousing conditions. One of the arousing conditions was that
9 you were told that at any moment a very loud and aversive aversive sound would
10 come out very unpleasant sound. What we found was that if you compared the
11 teenagers the eighteen to twenty-one-year old's and the adults under
12 emotionally neutral conditions when people were not aroused, the eighteen to
13 twenty-one-year old's performed and their brains looked like adults. But if you
14 you did the same experiment but you emotionally aroused people, the eighteen
15 to twenty-year old looked like the teenagers and not like the adults. So to
16 answer the question, um under conditions of emotional arousal eighteen to
17 twenty-year old's eh twenty-one year old's brains look more like the brains of
18 teenagers than they do like the brains of adults.

19
20 D: And this is the result of some kind of negative emotional arousal?

21
22 W: It in this particular study this was negative emotional arousal.

23
24 D: Um, and let me ask you to to say how can your studies inform the decisions as to
25 inform decisions as to punishment and rehabilitation?

26
27 W: Well, I don't want to venture into a a legal...

28
29 D: Okay.

30
31 W: that's not my area of of...

32
33 D: Okay.

34
35 W: expertise. I think that to the extent that um courts want to take eh the this kind
36 of science into account, it it, should eh it should ask the court or encourage the
37 court to consider ways in which people um uh at at this age may be less mature
38 and therefore less responsible or less culpable. Uh eh a different way of putting
39 it is I think that the the way in which the court referred to science in the *Roper*
40 and *Graham* and *Miller* decisions is correct. And in the sense that they use that
41 science to form an opinion that younger people were not as mature as older ones

1 and therefore less culpable and less responsible and less deserving of the the the
2 punishments we reserve for the worst of the worst.

3
4 D: And when you talk about those individuals you're talking about people who are
5 twenty years old correct?

6
7 W: I would say that they're in the group of people who are characterized by the
8 same uh three phenomena that Kennedy wrote about in *Roper*. Impulsivity
9 susceptibility to coercive influence of others and still having characters that are
10 not yet heartened. So that it is my opinion that if if a if a different version of
11 *Roper* was heard today, knowing what we know now, one could've made the
12 very same arguments about eighteen nineteen and twenty year old's that were
13 made about sixteen and seventeen year old's in *Roper*.

14
15 D: And these findings have been peer reviewed by other scientists?

16
17 W: Oh yes extensively.

18
19 D: Okay. So it's not just your opinion it's also what has been found by other
20 scientists who have been studying the same thing?

21
22 W: Oh it is it is not disputed by scientists that the brain continues to mature beyond
23 uh eighteen and into the mid-twenties that is an established fact.

24
25 D: Okay. Uh thank you Professor that's all the questions for you now but uh a
26 couple of the other lawyers may have questions and the Judge may have
27 questions. Thank you your Honor.

28
29 D2: Your Honor if I can ask...

30
31 J: Mm-hmm...

32
33 D2: just a few.

34
35 J: Sure.

36
37 D2: Um, you've spoken a little bit about culpability but how does a lack of brain
38 maturity in these individuals in their late teens and early twenties impact their
39 ability to, understand or process the concept of deterrence?
40

1 W: Well deterrence requires the ability to think eh systematically in a deliberative
2 way about the future consequences of one's action. Alright if if I'm
3 contemplating committing a crime, um and I'm thinking what could happen to
4 me in the future uh oh there's gonna be a bad outcome if I get caught that might
5 stop me from committing that crime but if I don't have the capacity or the
6 inclination to think about what's going to happen in the future then something
7 isn't going to deter me and as I said before, one of the hallmark features of
8 adolescent thinking is that they are very focused on the immediate and not
9 focused on the longer term. So, in my opinion to be deterred in a criminal
10 situation you can't just focus on the immediate you have to be focusing on the
11 longer term. Especially if what's deterring you eh is the knowledge that
12 something happened to somebody else no not not even you in a in a previous
13 time.

14
15 D2: And um, you mentioned one of the factors that the court focused on in *Roper*
16 was being more vulnerable to negative influences or outside pressures...

17
18 W: Yes...

19
20 D2: or their peer influences. Um how do those in their late teens early twenties react
21 differently to peer pressure than adults?

22
23 W: One of the things that we study in our lab at Temple University is the impact of
24 the presence of peers on decision making. And we've done studies in which we've
25 compared teenagers college age students uh those who are between eighteen and
26 twenty-two and people who are twenty-four and older. And we have looked at
27 how they behave in situations when they're alone and compared them to their
28 behavior in situations when other people their same age were around. And one of
29 the things we've shown in several experiments is that, in the presence of peers
30 adolescents and young adults make significantly more risky decisions than they do
31 when they're by themselves but that people who are twenty-four and older don't
32 change as a function of whether they're with their peers or by themselves. And in
33 some brain imaging studies that we've done, we've shown why this is and what
34 seems to happen is that when kids and by kids I mean adolescents um are with
35 their peers this activates reward centers of the brain and it makes eh people pay
36 more attention to the immediate rewards of a choice rather than the potential cost
37 of a choice. So, peers activate their reward centers the activation of the reward
38 centers makes people take more risks. Eh it helped us answer a question that I
39 think people have wondered about for a long time which is why do young people
40 do such stupid things when they're with their friends that they wouldn't do if they
41 were by themselves. And we think we have an answer both in terms of the

1 psychology of it but also in terms of the brain underpinnings of it. So in just to
2 finish all the things that I was saying before about the deficiencies in adolescent
3 judgment, the short term um the lack of planning the impulsivity and so forth all
4 of those things are exacerbated they're made worse when kids are in groups than
5 with their when when they're by themselves.

6
7 D2: Okay. Um, you also mentioned that the adolescent brain is more plastic and has
8 the ability to change. Um is that in a positive way or in more um open to
9 rehabilitation in that sense?

10
11 W: Um it is in a both a positive way and a negative way. Um eh so that uh eh your
12 brain when when we talk about the brain being plastic it's it's a dual edged sword.
13 Um it means that the brain is more susceptible to positive influence but it means
14 that the brain is more susceptible to toxic influence as well. And the brain can't
15 tell the difference between good influences and bad influences and if it's plastic it's
16 influenced by both.

17
18 D2: But as compared to an adult age twenty-five or over the brain of an adolescent
19 might be more malleable to rehabilitation?

20
21 W: Probably yes. (PAUSE)

22
23 D2: And we've been talking on a very general level here about the adolescent brain.
24 Um is there a way to look at an individual specifically and establish where on a
25 scale they may be in terms of brain development and, and how does one do that?

26
27 W: No it would not because of my you could look at an individual's brain and you could
28 identify whether there was some malformation or an injury or a lesion or a tumor
29 but we do not have the the technology available as of now to look at individual
30 brains and put them along some kind of maturity scale it's not possible.

31
32 D2: Is there a way for them to do some sort of neuropsychological testing though to
33 establish how an individual is reacting um under certain situations?

34
35 W: Yes.

36
37 D2: Okay.

38
39 W: Uh eh it is possible for a neuropsychologist and clinical psychologist to test
40 individuals and make some statements about how they react under given situations

1 whereabout what strengths and weaknesses they have psychologically and
2 cognitively.

3
4 D2: I have nothing further at this time your Honor.

5
6 J: Alright. Commonwealth?

7
8 P: Thank you. Good morning Doctor.

9
10 W: Good morning.

11
12 P: Um I wanna follow up on the que last question and that is that it would be possible
13 to test individuals through psychological testing to determine where they are in
14 this maturing process?

15
16 W: Yes although uh eh I it uh and we think that there yet is consensus among um
17 among clinical psychologist about what the best instruments are to do that but I
18 do believe that there are clinical psychologist who feel confident that they can test
19 individuals and make statements about the relative degree of maturity of this
20 person or that person. That's not me...

21
22 P: Right.

23
24 W: but there are those who can.

25
26 P: But that would seem to um suggest that people do matu their brain does mature
27 at different rates...

28
29 W: Yes.

30
31 P: So when you say that um, and you you've we've defined adolescence as ten to
32 twenty-five is that kind of...

33
34 W: Um I well today I said I was gonna talk about it as as ten to twenty-one...

35
36 P: Okay.

37
38 W: um...

39
40 P: But some of the literature talks about twenty-five...

41

1 W: Yes. Right...
2
3 P: I mean does the literature distinguish between twenty-one-year old's and twenty-
4 five-year old's?
5
6 W: Um, not, not between twenty-one and twenty-five at a on a brain level. I think
7 there are some people like myself who've written about the fact that some
8 behaviors that we still see in people who are twenty-four still look somewhat
9 immature and some of our research that we've done in the United States and in
10 other countries shows that twenty fi four-year-old twenty-five-year old's they're
11 still a little bit more impulsive than people who are twenty-seven or twenty-eight.
12 But that brain science isn't there yet at that at that end of the continuum.
13
14 P: But you feel like the brain science is there for those that are under twenty-one?
15
16 W: Yes I do.
17
18 P: And um, what about I mean you've talked we talk about and you mentioned and
19 I've read several of your articles about um risk taking or reckless behavior. And I
20 I think I have some concept of that but is there a difference between risk taking
21 and reckless behavior in the in the non-criminal sense and risk taking and reckless
22 behavior in the criminal sense?
23
24 W: Only in the sense that the behavior is against the law in in the latter but not in the
25 former. But I eh if I take your question correctly, um I think it is it is possible to
26 account for non-criminal risky behavior during adolescence using a lot of the same
27 language that we use to describe criminal risky behavior during adolescence.
28
29 P: But it but, you know in general I mean just generally speaking there are plenty of
30 youth between the ages of ten and twenty-one that don't engage in that might
31 engage in risky activity like tying a mattress on the back of a car driving around
32 versus pulling a gun on someone and trying to take something from them...
33
34 W: Absolutely. So so even though um adolescence is a time of, relatively more risky
35 behavior that manifest itself in different ways in different people.
36
37 P: Now in terms of cognitive development uh is the is the uh twenty-year-old brain
38 cognitively developed?
39
40 W: Yes.
41

1 P: And in terms of um, there's something else that goes along with with cognitive
2 development um reasoning.
3
4 W: Yes.
5
6 P: It's so at the age of eighteen a person can reason, and think like an adult?
7
8 W: Ye yes although, it is easier to disrupt the reasoning abilities of a of an eighteen-
9 year-old by making that person emotionally aroused but in but in situations where
10 emotions are kind of tamped down and in which there's not a lot of stress or time
11 pressure under ideal situations, if I was giving you a reasoning test in a nice quiet
12 room...
13
14 P: Mm-hmm...
15
16 W: um and you were sixteen you would perform just as well as an adult would on that
17 test...
18
19 P: Okay so so that would mean that at the age of eighteen a person knows the
20 difference between right and wrong...
21
22 W: Absolutely.
23
24 P: um a person understands that what they're doing is wrong?
25
26 W: Absolutely.
27
28 P: And this this concept of then that it's it has to do with um, peer pressure and
29 impulsivity do you in in your opinion about those things do you think that translates
30 into other a significant decisions um that have long term consequences for
31 eighteen-year old's like for example um, getting married? We know the legal age
32 of getting married is eighteen some places sixteen perhaps.
33
34 W: Um, I I do think it's uh hard for me to answer that kind of with a sweeping
35 statement um, eh yes and that's why for for some of these decisions um we try to,
36 we try to structure them so that eighteen-year old's have the the wisdom of adults
37 to to guide their decision making...
38
39 P: Mm-hmm.
40

1 W: um but, well I'm sorry to to eh maybe you can re you can restate the question for
2 me?
3
4 P: Well using your your the understanding of the science as you've represented it to
5 us should we change the age of of maturity to make decisions about getting
6 married to twenty-one? Should it be that you have to be twenty-one years of age
7 or older to get married?
8
9 W: Um, I wouldn't change it for getting married um, mm...
10
11 P: What about driving a car?
12
13 W: I I think the driving age should be raised to to to...
14
15 P: Twenty?
16
17 W: um well uh I think it should be raised at least to eighteen.
18
19 P: Because those take...
20
21 W: And I and I have written that. I eh that that I think this that because of what we
22 know about sixteen-year old's um the impulsivity and uh um, deficiencies in
23 miscalculation make me nervous about sixteen-year old's driving.
24
25 P: But eight you're okay with eighteen-year old's?
26
27 W: I think for any, legal decision about drawing a boundary...
28
29 P: Mm-hmm.
30
31 W: we have to consider science along with other things...
32
33 P: Right.
34
35 W: Now in because there are eighteen-year old's who need to drive to get to work,
36 we might factor that into a decision about uh the driving age. So so I might say if
37 there were no other considerations than scientific considerations maybe we should
38 have the driving age be twenty-one but I know that there are considerations other
39 than scientific considerations and therefore we have to do our best job of weighing
40 all these different factors.
41

1 P: Okay and do you feel the same way about um marriage?
2
3 W: Um, marriage seems different to me I can't exactly tell you why but it seems
4 different to me.
5
6 P: But it has long term consequences obviously...
7
8 W: Of course it, of of...
9
10 P: what about decisions about one's body? Medical decisions?
11
12 W: Yes and I've and I've...
13
14 ? (INAUDIBLE)...
15
16 W: written about that um and I believe that when young people are have an
17 opportunity to make decisions about their bodies um that we should try to structure
18 those decisions so that they have available to them the counsel and guidance of
19 adults.
20
21 P: And would you would you um, propose that those kind of decisions be weighted
22 until a person was over the age of twenty?
23
24 W: No.
25
26 P: So eighteen for that ag for...
27
28 W: For...
29
30 P: those kinds of...
31
32 W: yes...
33
34 P: decisions...
35
36 W: because I think I I think that making good decisions at that age and there's some
37 research on that making good decisions about those kinds of things whether to
38 have a medical procedure or not um we we know that the competence to make
39 those decisions develops by the time people are sixteen or so.
40

1 P: Are there other things besides uh the immature brain that would cause a person
2 that is twenty years of age to engage in criminal activity?
3
4 W: Of course.
5
6 P: Like what?
7
8 W: Um pressure from antisocial peers...
9
10 P: Mm-hmm.
11
12 W: um, eh perhaps some im immediate uh, experience like an altercation that might
13 let led somebody to behave in an aggressive...
14
15 P: Mm-hmm.
16
17 W: way um, having had parents who were abusive or treated the person harshly so
18 there are other factors in people's lives other than their brain that lead to antisocial
19 behavior.
20
21 P: And in fact those kinds of things happen to people that are over the age of tve or
22 twenty-one or older or even twenty-five and older...
23
24 W: That's...
25
26 P: right?
27
28 W: correct.
29
30 P: What is your personal opinion about the death penalty?
31
32 W: Um I'm opposed to it.
33
34 P: And is have you always been opposed to the death penalty?
35
36 W: (SIGHS) Uh I'm no I've changed my mind a a you know o o over um recent years
37 ha for reasons that don't have anything to with this...
38
39 P: I understand...
40

1 W: for reasons that have to do with the um, some of the DNA evidence and
2 exoneration and then then questions in my mind about the, um, uh a uh about
3 mistakes that can be made in in reaching decisions and about the irreversibility
4 obviously of the penalty.
5
6 P: And have you written on that subject...
7
8 W: I have not.
9
10 P: specifically about the abolition of the death penalty?
11
12 W: Well I've written about the juvenile death penalty...
13
14 P: Okay...
15
16 W: but not about the death penalty in general...
17
18 P: For adults?
19
20 W: Right.
21
22 P: Have you testified in other courts on this specific topic...
23
24 W: I...
25
26 P: I mean the...
27
28 W: I have not I did I'm not sure your Honor whether it counts as testimony I did make
29 a presentation before the Arkansas State Parole board...
30
31 P: Mm-hmm.
32
33 W: in the recent series of cases um in which those eight men were being considered
34 for execution so I did present to the state parole board but that's as close as I've
35 I've done in terms of testifying on this issue.
36
37 P: Okay. Are there others uh that you're aware of that hold the same uh beliefs that
38 you do who have testified in st cour state courts uh on the issue of um eliminating
39 the death penalty for those less than tw uh twenty-one years of age?
40
41 W: Not that I'm aware of.

1
2 P: Okay as in you're aware that no state has a law that says if you're under twenty-
3 one you're not eligible for the death penalty?
4
5 W: Um I don't know one way or the other.
6
7 P: Okay. (PAUSE) I I just I need to ask this question are you being paid today to
8 testify?
9
10 W: Yes.
11
12 P: Okay and who's paying you?
13
14 W: Um well I I guess it's the well I'm I'm being paid by the (UNINTELLIGIBLE) by the
15 defender's office...
16
17 P: Mm-hmm.
18
19 W: I think that that's being paid by the Court.
20
21 P: By the Court?
22
23 W: I thi...
24
25 P: And how much are you being paid?
26
27 W: Five hundred dollars an hour.
28
29 P: Okay. And so at uh when you've finished your testimony today what will your
30 entire fee have been?
31
32 W: Um, I have to sit down and calculate it but there's the preparation and travel and
33 testimony and so forth. Um I think the Court said that it was a maximum of ten
34 thousand dollars.
35
36 P: Okay. (PAUSE)
37
38 W: May I amend one of my answers to one of your questions...
39
40 P: Certainly.
41

1 W: Uh well because when you were asking me about eh the the parallels between the
2 logic on this and on marriage and on medical...

3
4 P: Mm-hmm...

5
6 W: procedures and so forth uh what I didn't say and should've said is that my
7 understanding is that there is a long history of jurisprudence that says that death
8 is different and that the logic that we use to talk about death is not necessarily the
9 same as the logic that we use to talk about other kinds of punishments and other
10 kinds of situations so, eh I just wanted to add to that that I, I I would be hesitant
11 about making one to one correspondences between things like capital punishment
12 and things like the age of marriage or the age of driving or something like that.

13
14 P: Right I I understand that but we're still talking about judgements right I mean
15 when you get to when you strip away everything else we're talking about eh how
16 at what age is a person able to control their behavior make judgments and think
17 about future consequences.

18
19 W: Yes but we in the United States at least have been comfortable having different
20 ages for different legal decisions. Alright you can drive at sixteen but you can't
21 see an X-rated movie at that age um and you can't vote but you can vote at
22 eighteen but you can't buy alcohol at that age and you can buy alcohol you know
23 at twenty-one but you can't rent a a car from some car agencies until you're older
24 than that so that it doesn't bother me to have different ages for different legal
25 questions. And it's not inconsistent with American law. (PAUSE)

26
27 P: I know in *Roper* the decision the issue was really about people that were less than
28 eighteen um years of age, would if the iss question had been less than twenty-one
29 years of age in *Roper* with the information that you had at that time would you
30 have felt the same way?

31
32 W: No because there hadn't there wasn't adequate science and I it I have been trying
33 today and and you know in the in the past to ground my um opinions about these
34 matters in in science and the science just did not exist then.

35
36 P: But you feel like it does today?

37
38 W: I do.
39

1 P: Okay. And um, and I I've already asked you this but I just wanna make sure you're
2 you haven't or people with other op the same si situ opinion that you have about
3 the science have not testified in any other state court regarding this is that correct?
4
5 W: Regarding the death penalty?
6
7 P: Mm-hmm.
8
9 W: Correct.
10
11 P: Okay. (PAUSE) And one last um, is there anyway uh are there brains that are
12 twenty years of age or twenty-one years of age that are adequately developed um
13 in those areas that you have talked about and that would be peer pressure and
14 um susceptibility to peer pressure risk taking and thinking about future
15 consequences that would be just the same as a twenty-two year old brain or a
16 twenty-three year old brain?
17
18 W: Um, I eh there there may be I don't know because we don't have, as yet in in the
19 science of brain development we don't as yet have norms established to say what's
20 adequate and what's not adequate. Um maybe someday we will but we don't have
21 it now.
22
23 P: It so is twenty-one in your mind a bright-line like eighteen was in *Roper*?
24
25 W: Um, that's a legal question I uh I mean I was asked to opine here today about
26 people who are under the age of twenty-one. Um I don't whether twenty-one
27 should be a bright-line like eighteen as in *Roper* it's a question for for courts to
28 decide.
29
30 P: Yes but in *Roper* you all uh the amicus brief took the position that eighteen
31 should be the age.
32
33 W: No I think we took...
34
35 P: Is that right?
36
37 W: I think we took the position in responding to eh those particular cases that
38 sixteen and seventeen-year olds were not as mature as adults so I would also
39 take the stance here that nineteen and twenty years old's or eighteen nineteen
40 and twenty-year olds are not as mature as adults. I think where we draw the
41 bright-line seems to me to be a decision for the courts and for legislatures.

1 P: Do you think there should be a bright-line? (PAUSE)
2
3 W: (SIGHS) Well, it you you've asked me before so so I've already admitted that I'm
4 not in favor of the death penalty for anybody...
5
6 P: Right.
7
8 W: so eh it's a it's a purely hypothetical question as far as I'm concerned.
9
10 P: Well give me a hypothetical response.
11
12 W: (LAUGHS) Um, given the brain science if I had to draw a bright-line um I think
13 I'd be more inclined to draw it at an older age than twenty-one. Um by I think at
14 this point twenty-four is probably a more clo closely to the science if we're saying
15 when is the brain when are we absolutely confident that the brain is fully mature,
16 it's more around there.
17
18 P: Okay. That's all the questions I have...
19
20 J: Alright.
21
22 P: thank you.
23
24 J: Any redirect?
25
26 D: Uh yes just briefly. (PAUSE) Um, you were asked by one of uh eh by uh Ms. Red
27 Corn about um, reasoning by adolescents uh, and I believe you made the
28 statement that it's easier to disrupt reasoning of adolescents would that be under
29 situations of emotional stress?
30
31 W: Yes. On or under situations when they're in groups.
32
33 D: Okay. Um, so if you're not dealing with the ideal situation, you're talking about a
34 young person of the age of twenty-one being more easily disrupted having his
35 reasoning disrupted by an emotional disturbance?
36
37 W: Yes that was the point of our experiments that I described.
38
39 D: Okay. Um, and this is really just a simple question but mainly just to highlight uh
40 the court in *Roper* didn't have the benefit of the additional science that has
41 developed since two thousand and five (2005)?

1 W: Correct.
2
3 D: Okay. Uh, and the science, and you were cited by the court in *Roper*?
4
5 W: Yes.
6
7 D: And now that science is different?
8
9 W: Yes.
10
11 D: I have no further questions your Honor.
12
13 J: Alright.
14
15 D: Thank you.
16
17 J: Ms. Green?
18
19 D2: Nothing your Honor.
20
21 J: Alright any re-cross?
22
23 P: No your Honor.
24
25 J: Okay. Doctor just uh just a couple of questions I just for the eh I wanna be sure
26 when you were talking about those imaging techniques when did they start being
27 used as as a methodology for the research?
28
29 W: Um I believe they started being used eh eh in in the nineteen eighties (1980's)
30 but they weren't used in the study of adolescents until the late nineteen nineties
31 (1990's) and the first paper um on that was was I think either in nineteen ninety-
32 nine (1999) or two thousand (2000). They they had they had been um your
33 Honor as you me as you might surmise those techniques had been developed
34 mainly to deal with disease um and diagnosis and not to deal with research
35 questions about the the sort that we've talking.
36
37 J: Okay now you said that there are a lot of peer review journals uh that support
38 your theory...
39
40 W: Yes.
41

1 J: uh give me some of those, sources if you will...
2
3 W: Well there's the Journal of Neuroscience, um there's the Journal Nature there's
4 the journal...
5
6 J: Well yeah but I need some cites.
7
8 W: Oh some cites...
9
10 J: Yeah of studies...
11
12 W: okay...
13
14 J: that support this other than your writings...
15
16 W: off the top of my head it's...
17
18 J: okay well that's that's why we're here...
19
20 W: yeah...
21
22 J: and uh eh counsel for defense is there's all this science...
23
24 W: yeah...
25
26 J: and I understand your testimony...
27
28 W: sure...
29
30 J: I understand you've written. I'd be interested in what other peer review journals
31 support your theory.
32
33 W: Well well there are papers by a sc um pa the first author is BJ Casey. C-A-S-E-Y.
34 Um there's a very important paper by a scientist whose last name is Dosenbach
35 D-O-S-E-N-B-A-C-H. There is um an important paper by a scientist by the name
36 of Gogtay G-O-G-T-A-Y. Uh um if there's some way to get information to you
37 after this I'd be happy to um to provide the full citations.
38
39 J: Well you you can certainly supplement your testimony...
40
41 W: Okay.

1 J: Yes. And these are now eh I'm I'm interested in the science uh for the issue that
2 the defense is bringing up the eighteen to twenty-one-year-old...
3
4 W: Yes.
5
6 J: And is this science that has come out since *Roper*?
7
8 W: Yes.
9
10 J: Okay. How long would it take you to get these citations to supplement your
11 testimony?
12
13 W: I mean well I could get em' as soon as I'm home and at my computer. And how
14 how would you like me to get that information to the...
15
16 J: You'd just get em' to counsel and then...
17
18 W: okay...
19
20 J: they could file it and give a copy to the Commonwealth.
21
22 D: Yes.
23
24 J: Okay. Any subsequent questions from my after my questions any?
25
26 P: No your Honor.
27
28 J: Okay. May this witness be excused then?
29
30 P: Yes your Honor...
31
32 D: Pardon me?
33
34 J: May this witness be excused?
35
36 D: Yes your Honor.
37
38 J: Okay. Very well Doctor thank you very much for your testimony...
39
40 W: Thank you.
41

1 J: Alright. Any other witnesses?
2
3 D: No other witnesses your Honor.
4
5 J: Okay. Does the Commonwealth have any witnesses?
6
7 D: No your Honor.
8
9 J: Okay. Very well. Alrighty we're adjourned uh we've got a didn't we have a
10 subsequent status date or?
11
12 P2: I don't I don't think so Judge but we haven't seen the order for the KCPC
13 evaluation for the def three defendants yet.
14
15 J: Um we've su I've signed every order that's been submitted oh is this an agreed
16 order or is...
17
18 P2: No sir. When we were in court two weeks ago, you...
19
20 J: Yeah...
21
22 P2: um, um...
23
24 J: I ordered...
25
26 P2: ordered that each of the...
27
28 J: Yeah...
29
30 P2: three defendants would be sent to KCPC...
31
32 J: Okay.
33
34 P2: And we have not...
35
36 J: So that hasn't been...
37
38 P2: seen that yet...
39
40 J: entered?
41

1 P2: No.
2
3 J: Okay.
4
5 P2: Yes no sir.
6
7 J: Okay we've got the file upstairs I'll double check I don't know why that hasn't
8 been entered.
9
10 P2: Okay.
11
12 J: But we'll get that done...
13
14 P2: Thank you.
15
16 J: anything else?
17
18 D2: Your Honor I just wanted to make sure the Court received um Friday we
19 supplemented our motion for uh the *Roper* extension with an affidavit from
20 Doctor Benedict?
21
22 J: Uh we I did receive that the Commonwealth received that as well.
23
24 P2: Yes.
25
26 J: Yeah I did get that.
27
28 D2: Okay. Would you like to set another status date? Okay...
29
30 J: I'd I don't think so. I think it's under advisement. Uh they're we got some
31 rulings under advisement I don't see any reason for another status date unless
32 you all do do ya?
33
34 P2: No your Honor. I think this is the only issue before the...
35
36 J: Yeah.
37
38 P2: Court.
39
40 J: That's what I thought so too.
41

1 D2: The only reason I thought we might want a status is um since, if we wanted to
2 su set some dates to do to do jury, selection...
3
4 J: Yeah.
5
6 D2: issues.
7
8 J: Yeah on those uh let me get with the court administrator and then we maybe we
9 can do a conference call to pick a date to do that...
10
11 D2: That's fine.
12
13 J: jury that'll work with your all's schedules as well.
14
15 D2: Because Mr. Gonzales' attorney is not here right now.
16
17 J: Right.
18
19 D2: So would be...
20
21 J: Okay.
22
23 D2: hard to pick a date...
24
25 J: Alright. Very well. Alright thank you all very much...
26
27 D2: Thank you.
28
29 J: We're adjourned.
30
31 TRACK CUTS OFF/END OF TRACK