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Neurolaw and the mind-brain problem in practice: The case of psychological immaturity and brain immaturity

Abstract: The law today cannot ignore the findings of neurosciences. These are in fact being included in legal codes, as was the case with the recent Dutch juvenile justice reform. Indeed, even when the contribution of neuroscientific evidence appears to be clear and circumscribed, it brings out some very important issues, which are both ontological and epistemological. For now, we do not really know how to solve these issues, but we can proceed with caution, avoiding the extremes of either rejecting or uncritically adopting neuroscientific categories in our legal systems. Since the law is, at least in part, conventional, we could consider an approach like the one proposed by J. Searle, which seeks to combine naturalism and the preservation of mentalistic categories. This position is probably not the most correct one (provided we do not know which *is* the most correct one), yet it allows us to design a neurolaw that is in tune with science but does not entail a complete legal revolution, taking neuroscience seriously while also maintaining some seemingly indispensable categories of law.

Keywords: liability; juvenile justice; retributivism; consequentialism; desert; Searle

1. Brain immaturity: a challenge for neurolaw

The common opinion that adolescents are incapable of adopting a mature behavior finds an explanation today on a neuroscientific level. It is not just a matter of hormonal fluctuations; it is the still incomplete brain structure that affects the behavior of minors. Thanks to recent neuroimaging techniques, researchers are now able to observe what happens inside young people's brains, and the findings show that, during adolescence, the brain is in fact still in a development phase (Giedd, et al., 1999). Within the adolescent brain, profound structural changes take place that seem to greatly influence (together with other factors) the observable behavior (Casey, et al., 1997), making adolescents more predisposed, compared to the

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adult population, to engage in deviant behavior. According to Steinberg and Scott (2003), adolescents exhibit three characteristics: deficiencies in decision-making capacity, heightened vulnerability to coercive circumstances, and unformed character due to developmental immaturity.

Brain immaturity would therefore constitute one of the triggers of juvenile delinquency.[1] In particular, it seems that the relationship between incomplete brain development and predisposition to crime results from the fact that the prefrontal cortex – the brain area located behind the forehead and connected to self-control and the ability to make rational decisions – is the last brain area to fully mature (around 20-22 years of age). It also appears that, unlike in adults, the altered interaction between the activity of the amygdala, the ventral striatum and the prefrontal cortex constitute the neural correlates of the tendency to impulsivity, as well as the intense susceptibility to the immediate reward system and to social evaluation (Somerville, 2013). These brain changes, while increasing the incidence of socially sanctioned conduct, are actually functional to the survival and separation of adolescents from their parents, and occur during the adaptive transition from a state of dependence to one of independence (Galván, 2014).

For these reasons, the problem of brain maturity in relation to juvenile liability is definitely a big challenge for neurolaw. Neuroscientific findings tend to move further and further away from the idea that maturity is equivalent to reaching the age of majority, rather leaning towards the idea that brain maturity is the necessary condition of mental capacity, which cannot be assumed if the brain has not completed its natural development. This is the crux of the relationship between mental states and/or the manifest psychological functions that the law has always considered as necessary prerequisites for the liability of a subject (to stick to the criminal sphere) and their neural correlates (to use a neutral term that still does not presuppose either causation or determination). In general, it can be said that the conventional threshold of the age of majority, which most legal systems place as a separation between those who are subject to criminal law and those who are sub-

1 It should be immediately specified that we are working within the intersection and the complex relationship between different levels of explanation. The statement that "brain immaturity would constitute one of the triggers of juvenile delinquency" is therefore not a neutral description of a state of fact, but a statement that incorporates evaluative and normative aspects. In fact, the immaturity of the brain is a concept that combines a description of the state of the brain of the average young person with an assessment of the fact that it has not yet reached the final stage of development that is found in adults, implying a negative judgement on this stage in relation to some, although not all, behaviors of young people. In fact, we can appreciate what we informally call the freshness and naivety of children, also due to the immaturity of their brain, while we reproach deviant behavior. The legal concept of delinquency itself is exemplified here by the violation of rules that are conventionally set out to establish what types of adult behavior are and are not acceptable to society. This boundary can change, regardless of considerations about the stage of brain development of those who perform specific actions, and cause the alleged brain immaturity of young people to become legally irrelevant, although it can still partly causally explain the relative frequency of certain behaviors. It is this intricate terrain that we wish to explore in an attempt to find easier pathways.

ject to different rules (juvenile law), is also established in relation to the scientific knowledge of the time when the decision is taken.

However, until now, the knowledge in question has been a rather superficial understanding of behavioral psychology. The lowering of the age of majority in Italy, for example, was mainly motivated by the greater social involvement of young people that characterized the sixties and seventies and not by new scientific knowledge[2]. In other words, in law, the age of majority is linked to the presumed ability to understand one's own conduct and to modulate it appropriately according to the circumstances. This is supposed to occur on the basis of beliefs and intentions as well as on the sufficient development of memory and executive functions such as reasoning, logical and abstraction skills, as manifested in one's behavior or detectable by appropriate tests. This general condition does not seem to be present in young persons compared to adults, hence the distinction and the setting of a threshold, which being the same for all, is necessarily conventional.

At this point one might ask whether neuroscientific findings should influence the legal system. It should be emphasized, in fact, that the description of reality, which is always nuanced and complex, does not necessarily have to be transformed into a prescription that, given its categorization approach, draws clear and precise boundaries (Jones and Wagner, 2018). However, it is reasonable to consider that current neuroscientific findings undoubtedly suggest an inconsistency between the law and what neuroscience tells us about brain development, so that this conflicting relationship could, at least potentially, inform us of the need of a juvenile justice system reform; it is also reasonable to state that a number of young adults cannot be considered fully responsible for their actions, because their neurobiological immature make-up render them at least partially incompetent (Lavazza and Sammicheli, 2012).

A well-known example of the influence of science on this subject is the Roper v. Simmons ruling. Even if not explicitly mentioned, neuroscientific findings and research in developmental science might have influenced the US Supreme Court decision to declare death penalty for juvenile offenders unconstitutional in 2005, confirming the idea that capital punishment of offenders who committed murder before age 18 is "cruel and unusual" as it violates the Eighth Amendment of the United States Constitution[3]. Given these considerations, if we take seriously the scientific findings that show that brain maturation is not fully completed until around the age of 20-22 (Gogtay, et al. 2004; Mills, et al. 2014), does it still makes sense to refer to the criterion of "reaching the age of majority" in order to be able to speak of full liability? From a scientific perspective, we believe this criterion is susceptible to a certain arbitrariness. In fact, it seems that brain immaturity extends well beyond what is considered the temporal boundary of the age of majority, so that on a neurobiological level young adults between 18 and

2 Law (legge) March 8, 1975, no. 39.
3 Roper v. Simmons, 543 U.S. 551 (2005).

22 years-old are, at least in some respects, much more similar to adolescents than previously thought.

Indeed, young adults show psychological and behavioral characteristics similar to adults in some ways, and similar to adolescents in others; in neutral environmental contexts, young adults behave in a very similar way to adults, but if the environmental context is characterized by high affectivity, young adults implement behaviors much more similar to those of adolescents (Cohen, et al. 2016; Jones and Wagner, 2018). The reference context therefore seems to largely influence the maturation of young people's behavior, but the neuroscientific dividing line between adolescence and young adulthood is much more nuanced than that underlying juvenile criminal law: becoming an adult in a legal sense does not coincide with becoming an adult in a biological sense. The idea of an age of majority, and consequently of full liability, established by the criminal code conflicts with the empirical evidence which, on the contrary, underlines its groundlessness.

But this series of statements brings us back to the topic of this article through a concrete case study. In fact, this is about assessing how neuroscientific knowledge can affect law. And the first access route seems to be precisely related to the way in which a conceptual approach and a mentalistic vocabulary such as that endorsed by law interact with a scientific approach and a cerebralistic vocabulary typical of neuroscience. Are these two levels of explanation autonomous or is one of them more basic? Should one give way to the other? (Fodor, 1974; Churchland, 1986; Craver, 2007; List, 2018). In any case, can we talk about neurolaw, i.e. a discipline that takes on both the categories of law and the categories of neuroscience without irreconcilability in principle? In course of the present discussion, interesting epistemological questions will emerge, which are at least less complex than the scientific and metaphysical questions about the relationship between mind and brain. By analyzing the case of the age of majority and brain maturity we will therefore try to explore the issues we have mentioned, without however claiming to reach a definitive solution.

2. The Dutch case of juvenile justice

A noteworthy attempt to adapt criminal law to neuroscience was made in the Netherlands in 2014. As of 1 April 2014, the Dutch juvenile justice system provides for the possibility of applying criminal law to young adults aged 18 up to a maximum of 22 years. Young adults responsible for committing a crime between the ages of 18 and 22 (and in any case before reaching the age of 23), are therefore able to access less severe penalties, as provided by the juvenile criminal system for juvenile offenders aged 12 to 17 years (Barendregt and van der Laan, 2019). According to the Council for the Administration of Criminal Justice and Protection of Juveniles, recent neuroscientific findings indicate that young people between the ages of 15 and 22 have a greater chance of developing antisocial behaviors, due to incomplete brain maturation; the brain development does not actually end around the age of 18, but continues well beyond the 20s. It is precisely the different brain

functioning of adolescents and young adults compared to that of adults that causes a greater incidence of the criminal phenomenon in this age group (Schleim, 2020).

The Dutch case is therefore a concrete example of how neuroscientific findings can influence the law, in the direction of a criminal law policy that is as coherent as possible with what brain research indicates.[4] Furthermore, the idea of brain immaturity is connected to that of neuroplasticity, a principle that also supports the effectiveness of rehabilitation and re-education programs for crime prevention, for the long-term reduction of relapse rate and thus the orientation of youthful behavior towards socially desired goals. In this way, more emphasis is placed on pedagogical goals, rather than punitive ones (Schleim, 2020).[5] In essence, it would be possible to intervene in time on the not-yet-fully-developed brains of adolescents who, for example, live in unfavorable socio-economic and environmental contexts, in order to prevent the repetition of socially inadequate behavior (or the formation of a brain habitus that would then permanently condition the subject).[6]

While having the merit of not turning a deaf ear to neuroscientific findings, the new Dutch juvenile criminal law is controversial in some respects. First, in general terms, biological phenomena are never static. The brain is constantly evolving at every stage of life, and different parts of the nervous system reach the peak of de-

4 One may wonder, without delving into sociology of law, what are the underlying reasons behind the focus on neuroscientific findings, in the Dutch case and in others. One option is (a) the "success" of neuroscience and its impact on general culture also because of the fascination that its findings exert. A second option is (b) the generically naturalistic, in this case cerebralist, orientation which comes from the growing weight of hard sciences in our societies, both because of their technological implications and because of their theoretical structure which refers only to what is observable and measurable. A third option is (c) the actual relevance of neuroscientific findings with respect to what the law is concerned with, i.e. the motives of behavior and the limitations which an incomplete brain development is supposed to place on young people in compliance with laws devised for adults.

5 As in the case of brain immaturity, it should be pointed out that the concept of plasticity can also be perfectly described in neuroscientific terms, but here it is already "translated" in terms of manifest behavior depending on a particular configuration of the brain architecture. This assumes that the juvenile window of brain plasticity is more functional to the offender's recovery than any other phase of their later life. This idea is also found in common sense, which sees older people as less willing to change and learn new skills. But it does not necessarily follow that young people can be more easily induced not to commit crimes than adults. Once again it is yet to be demonstrated that what is observable in the brain is the direct cause of a behavior, ability or impediment to achieve a certain mental state (such as the intention not to commit a crime). A humanitarian sense can make us shift towards non-afflictive correction instruments, but neuroscientific knowledge may not necessarily lead us to exclude traditional punitive instruments.

6 The interaction between genetic and environmental factors and the influence of environmental factors on brain development are elements that complicate a view of pure brain determinism. If in fact it may be the case that the brain make-up that the subject happens to have at the completion of their physical development (let's say at the age of 25) determines at least in part their behavior, it is true that the brain architecture and function (which end up orienting the subject's behavior) are the result of elements external to the subject's skull as well. The theme is too complex to be properly addressed here.

velopment at different times, and not simultaneously. As highlighted by Schleim, the brain processes:

> […] change gradually on a continuum and not in a categorical way, raising the question: How different would the brain processes or structures between two age groups have to be to justify a legal difference? (Schleim, 2020, p. 6).

In essence, it is difficult to refer to an "objective" biological maturity, as this is also rather influenced by contextual elements which are external to the individual. Paradoxically, one could say that the brain of the elderly is of a particular type and that it is beginning to be less efficient than that of the average healthy adult. Should we then also consider a specific law for those who exceed a certain age threshold? The legal system has never considered such an eventuality because there is no specific tendency to delinquency in the elderly population (in fact, crimes decrease in older age cohorts). But it could be argued that the few elderly offenders deserve special consideration because of their brain architecture and function, which have changed over time.

However, it can be assumed that a relevant marker of a mature brain might actually be a relative imperviousness to the context rather than any static pattern of neural activation or connectivity (Somerville, 2016), and it seems that the brain does not reach such "impermeability" before the age of 20. These data would support the idea that adolescents and young adults are not fully responsible for their misconduct because the high permeability of their brain would reduce their counterfactual reasoning, as well as their ability to inhibit impulses. Even if an immature brain does not necessarily always cause deviant behavior, brain maturity seems to be an indispensable biological basis in order to speak of full liability.[7]

> The other main objection concerns the fact that not all those who commit a crime show an altered brain profile, nor is it the case that all those who have an altered brain profile are offenders (Lavazza and Sammicheli, 2012, p. 244).[8]

This objection brings attention to the fact that brain immaturity, *per se*, might not be sufficient to account for the complexity of the juvenile delinquency phenomenon. The concept of brain immaturity, in fact, is different from the concept of immaturity implicit in criminal law (but also from that implicit in psychiatry; cf. Van Oudenhove and Cuypers, 2010). We have, on the one hand, an idea of brain maturity that is provided by neuroscience and, on the other hand, a more traditional conception of psychological maturity that is suggested by law.

These two meanings of maturity might of course not be mutually exclusive, but what is important for neurolaw is the attempt to understand how brain immatu-

7 Once again, this kind of causal explanation may appear to be a shorthand for a much more articulated and complex path, whose articulation is far from clear. And being "shaped" by one's own environment is not exclusive to young people, because this phenomenon occurs at all ages.

8 Translated from Italian.

rity and psychological immaturity interact, as well as which kind of immaturity is the most decisive in determining whether or not an individual has a given mental capacity. In particular, the question is whether it is a brain state that determines the lesser ability of adolescents and young adults to control impulses and make rational choices, or whether this inability derives from the inadequacy of the brain to support the mental states presupposed by liability. In other words, what is the relationship between brain states and related mental states?

In the genesis of juvenile deviance, the Dutch case seems to attribute fundamental causal relevance to brain immaturity (Schleim, 2020), but it does not explain how this incomplete brain development results in the antisocial behavior of adolescents and young adults. Even from a neuroscientific perspective, the scientific papers taken as a reference by the report for the Dutch Council for the Administration of Criminal Justice and Protection of Juveniles seem not to be particularly relevant and clear in order to justify the shift of the age of majority way beyond 20.

In particular, three criminological and psychological studies are cited: Adleman et al., 2002, Casey et al., 2005 and Paus et al., 2001. In the first paper, the fMRI showed greater activation of the prefrontal cortex (which is involved in the ability to control impulsive reactions) in young adults aged 18 to 22 compared to adolescents aged 12 to 16. The study also showed "that there was a similar pattern when comparing the young adults and the children; comparing the adolescents and the children did not yield such a result" (Schleim, 2020, p. 5). The experiment, therefore, would not seem to scientifically justify treating adolescents and young adults equally on a criminal level, since the fMRI actually highlighted brain differences between the two age groups. Similarly, the second paper (Casey et al., 2005) does not seem to clarify the issue and merely states that the prefrontal cortex develops completely by age 16. Finally, the third paper (Paus et al., 2001) gives evidence of how brain development lasts at least up to age 30 and that "there are big inter-individual differences within each age group" (Schleim, 2020, p. 5). This indicates that brain development occurs in an extremely gradual and nuanced manner, in such a way that – indeed – any type of clear and defined legal category is called into question.

On the other hand, it can be stated that also from a psychological point of view the concept of maturity is difficult to be summerized in a single definition, since it refers rather to a set of aspects and characteristics which, however, do not necessarily manifest themselves simultaneously in the same individual (thus, for example, one can be irresponsible but not impulsive, as well as one can be emotionally dependent but not endowed with little empathy). The fact that maturity is rather a spectrum than a precise threshold, makes it even more complicated to infer specific explanations and, in the absence of the latter, there is inevitably room for some form of arbitrariness and the risk of jurisdictional inequalities (Barendregt and van der Laan, 2019). Accordingly, a correct evaluation of immaturity would be necessary in order to consider it as a proper mitigating factor and in this regard neuroscientific research can certainly contribute to providing empirical evidence that the law requires.

3. Preliminary issues concerning neuroscience and law

The development of research in the field of neuroscience is proceeding in a gradual and nuanced way as well. In fact, this field is still young, and its findings remain susceptible to being disproved or resized in scope, as the many new details of brain functioning are unveiled. During the history of neuroscience, there have been numerous cases in which the initial enthusiasm for specific findings which seemed to be able to fully explain some human behavior was considerably curbed after further research and insights (Cobb, 2020). For example, the theory of mirror neurons developed by Rizzolatti and his team of researchers at the University of Parma, whose implications have been considered among the most important in the neuroscientific field, is not unanimously accepted by the scientific community today, especially when it is claimed that the role of mirror neurons can provide an all-encompassing explanation of human behavior (Hickok, 2014).

Likewise, there is no unanimous scientific opinion with regards to the existence of a deterministic relationship between some genes and mental disorders. In a recent important paper, for example, it is denied that there is any evidence of any association between 18 genetic polymorphisms and the development of major depression. And yet until now this hypothesis seemed to be instead corroborated by the scientific data available, which linked incurable forms of depression to the genetic make-up of the individual and not to their existential experience (Border et al., 2019). But even in cases where neuroscientific research can confidently affirm that genes and brain function are involved in the development of certain attitudes, there continue to be different interpretations of these findings – especially with regards to how the relationship between mind and brain and between brain and criminal behavior is described.

Specifying the nature of such relationships, and formulating it within an appropriate interpretative framework, is the preliminary challenge that neurolaw needs to face. The neuroscientific approach, in fact, is potentially able to change the anthropological commonsense view according to which human beings, as free agents, are liable for their own actions and should be sanctioned for their crimes. The classic idea that every human being is capable to make decisions autonomously contrasts with the neuroscientific view of human behavior, increasingly linked to brain automatisms over which the individual has no real control (cf. the well-known experiments by Liber [1983] concerning the onset of brain activity before the individual is aware of the inner process poised to trigger the action).

The intersection between law and neuroscience, therefore, inevitably leads to the clash between two different anthropologies (Lavazza and Sammicheli, 2012) that, at least at first glance, seem to be irreconcilable. On the one hand, the folk psychology that informs the law is intuitive and functional to survival in a collective space that requires human cooperation and the punishment of those who oppose it; it expresses "an intuitive conception of humans in the world, linked to folk psychology, which includes widespread assumptions, hypotheses and beliefs about behavior, subjective experiences and mental phenomena" (Lavazza and Sammicheli, 2012, p. 11).[9]

9 Translated from Italian.

On the other hand, the empirical method of neuroscience, which allows us to directly observe what happens inside our brain, gives us a very different image of the human being, no longer conceivable as a free and liable agent, but rather as an individual guided by a series of neurochemical processes that are in turn ultimately "determined" by the person's genetic make-up combined with the environment in which they happen to live. The scientific image of the human being seems to exclude that there is actually something similar to what the law calls liability, based on conscious and deliberate mental states, because our brain "makes decisions by itself, without our conscious supervision, at least not in the terms in which we usually consider the full awareness of a choice" (Lavazza and Sammicheli, 2012, p. 8)[10].

Since it can be said that only one who, with full control of one's faculties, freely decides to commit a harmful act deserves to be blamed, it is quite clear that the neuroscientific framework, at least if interpreted in the perspective of a strong reductionism, is potentially capable of undermining the foundations of the subjective elements of criminal liability. If at the roots of deviant behavior there is a certain neural architecture, whose mechanisms escape the conscious control of the individual, we are not entitled to consider the offender worthy of blame and punishment. In other words, the retributivism implicit in folk psychology would not be morally justified, because it would not correspond to the facts.

The classic distinction between minors and adults in the criminal field is certainly an example of how today it is possible, through neuroimaging techniques, to find the empirical evidence of a legal discrimination which, consequently, justifies the inequality of treatment. However, as already suggested above, the complex mechanisms that regulate brain activities place us in the condition of being able to identify, with a certain accuracy, the extreme poles of gradual neurodevelopment, but not so much the intermediate stages (e.g. young adulthood). More generally, the ontological question about the relationship between brain states and mental states constitutes the most problematic challenge for neurolaw – a fundamental question that also emerges in the Dutch case and which has given rise to theoretical doubts and ambiguities.

4. Neurolaw and the mind-brain problem

As pointed out above, neurolaw constitutes the point of intersection of two different anthropological perspectives. The implicit image of the human being found in folk psychology underlies the traditional justice system: in it, mental states have their own autonomy such as to serve as a basis for attributing blame and criminal liability. But the neuroscientific findings, at least so far, seem to point in the opposite direction and tend to *disprove* the idea that there are agents who are capable of free determination according to their own will. It rather leans towards reductionist cerebralism: the mind is just a physical phenomenon because mental states do not seem to be able to occur in the absence of the brain states to which they appear to be related.

10 Translated from Italian.

Obviously, it is not necessary to go back to the philosophical foundations of the relationship between mind and brain every time. Nor is it necessary to adopt the most radical interpretations of neuroscientific knowledge, according to which we cannot be free agents guided by causally effective mental intentions. One can simply consider that the mental states that concern the law have neuronal correlates that are at least *necessary* for the realization of the former (without prejudice as to whether the brain states are also *sufficient* to realize mental states). In this way it is not necessary to establish in advance whether we are free or whether we can have a certain degree of conscious control over our manifest behavior. In this sense, the law, which has already incorporated psychic and cerebral pathological states as mitigating or exempting factors, would not be "revolutionized" by neuroscience, but only made more precise. This is the case, for example, with the application of the articles of the penal code governing liability. However, as we are trying to show in this article, once we have embarked on the road to work on brain states, if we want to be rigorous and consistent we cannot stop halfway and, above all, it is necessary to unravel ontological and epistemological interpretative issues.

The results of a recent study conducted by Jones et al. (2020) are a good example of this. The experiment examined the mental states categories provided by the Model Penal Code (MPC) of the American Law Institute in order to identify the so-called *mens rea* inside the brain. In particular, the research focused mainly on the difference between "knowing" and "reckless" states of mind under which offenders commit crimes. These are two kinds of mental states, among the four identified by the MPC, that jurors most often tend to mistake for one another (Shen, et al. 2011). The aim of the experiment was therefore to clarify whether different brain states correspond to these mental states:

> Does the distinction between MPC *mens rea* categories, such as knowing and reckless, reflect an intrinsic psychological difference, actually found in human beings? If so, we believe that one should expect in principle that there would also be a difference between the brains of reckless and knowing individuals, at the times of their actions. Because, after all (and setting aside some philosophical subtleties) anytime there is a psychological difference there must also be a brain difference (Jones, et al. 2020, p. 7).

Knowing mental states provide that there is an awareness of the harmful consequences that misconduct can cause, even though there is not necessarily the intent to cause them; reckless mental states, instead, are defined as a conscious disregard of the consequences of a person's act. If a person sets fire to a house that has people inside, and he knows that his act can accidentally cause their death even though he does not intend to kill them, we are faced with a knowing mental state. But if the aggressor sets the house on fire without conscious regard for the consequences of his act, his mental state is defined as reckless.

The tendency to confuse these two mental states has prompted scholars to investigate their possible neural correlates. By using neuroimaging techniques and artificial intelligence algorithms, Jones and colleagues (2020) found that the two mental states of guilt, knowing and reckless, correspond to different brain states. Thanks to the use of functional magnetic resonance imaging (fMRI), it was also possible to predict

with a certain accuracy (71% of the time, and in some conditions) if the subjects examined were in a knowing or reckless state, suggesting therefore, as a proof of principle, the possibility of inferring from brain data the legally relevant category that a person belongs to (Vilares, et al. 2017; Jones, et al. 2020)[11].

In the Dutch case, however, the attempt to naturalize *mens rea* and punishment has revealed some underlying theoretical uncertainties. In particular, some ambiguities have been found (Schleim, 2020) regarding the way in which the relationship between mind, brain and criminal behavior is conceived. In 2011 the Dutch State Secretary of Security and Justice presented a proposal for juvenile justice in which the following justification was provided (Schleim, 2020):

> Research shows that many psychological functions which are important for the formation of socially desired behavior come to a full development only after the 20th year of age. This concerns, among others, the inhibition of impulses, the realization and consideration of long-term consequences, the regulation of emotions, and the development of empathic capacities. Considering the fact that these functions are not yet completely developed in adolescents, rule-breaking behavior and criminality occur relatively frequent in adolescents (Schleim, 2020, p. 3).

As highlighted by the author, "this suggests a causal link between the developmental stage of the said psychological faculties and offensive behavior" (Schleim, 2020, p. 3). But the following year, the Dutch State Secretary presented a new proposal for juvenile justice, providing a more "cerebralistic" justification, stating that "[…] modern research on the functioning of the brain aided by scanning techniques is said to explain that adolescents let themselves be guided more by brain parts reacting to immediate reward than adults" (Schleim, 2020, p. 3). According to this new interpretation of neuroscientific findings, therefore, the link between brain states and deviant behavior would be even stronger and more direct, somehow excluding the mediation of the mental element in the genesis of the crime.

To put it another way, in the Dutch case one can find the two main versions of a strong naturalistic paradigm, namely the reductionist version and the eliminativist version. Reductionism states that the higher levels of explanation (including the psychological faculties) can be attributed to neuroscientific explanations, while eliminativism purports to eliminate the higher levels of explanation used, for example, in traditional psychology, by declaring them illegitimate as too vague and abstract (this direction was taken by Paul Churchland [1981] and Patricia Churchland [1986]). According to eliminative materialism, the concepts to which the human and social sciences typically refer (such as intentional agency and liability) should not be downsized, but rather systematically *replaced* with the conceptual framework of neuroscience, the only one that properly corresponds to reality.

Now, eliminativism seems hardly acceptable for the criminal system since the latter relies on the efficacy of mental states. If a *mens rea*, as law has always traditionally understood it, does not properly exist, then there is no room for the

11 We do not have here the space to discuss this study more in depth. But it is clear interpretative issues arise when one introduces the idea of inferring mental states from neuroimaging.

principle of guilt which requires that, in order to establish criminal liability, in addition to the objective causal relation between the conduct and the event, the subjective element of the crime (namely the psychic link that binds the mental state to the criminal event) must also exist. Reductionism, unlike eliminativism, does not aim to make the higher levels of explanation illegitimate, but rather to translate them into the language of the natural sciences. In the reductionist perspective, therefore, the general aim is not to eliminate the conceptual categories to which folk psychology refers, but to interpret these conceptual categories in a naturalistic paradigm. However, it could be objected that, since mental states are essentially reduced to brain states, no moral significance could be attributed to the crimes committed by an individual (Humbach, 2019), because mental states would be ultimately traceable to brain states over which the individual cannot exercise any real control. How is it possible to justify the idea of liability if the concept of intentional agency has no place in the natural world and is therefore scientifically fallacious?

This deadlock can be addressed with an updated consequentialist approach to current neuroscientific knowledge, which shifts away from mental states as such and assesses how the penal system works. Indeed, it can be recognised that punishment has a deterrent function, regardless that individuals are driven by mental intentions, and that it protects society from offenders. In this sense, paradoxically, reductionism and even eliminativism do not dismantle criminal law in its concrete functioning made up of laws, sentences, convictions, and imprisonment, but deprive it the whole mentalistic apparatus of liability, intention and guilt. Now, the fall of the mentalist apparatus would be a revolution that no legislator or public opinion seems ready to accept, despite the new scientific findings (Lavazza and Corso, 2021). In fact, the retribution component, for which a person is punished for their intention to commit a crime and not only their objective and material responsibility for the crime itself, would be cancelled. This mentalistic element (which, including the subject's free will, is also the basis of blame and moral praise as it justifies the attribution of responsibility) differentiates the law based on folk psychology from the entirely naturalized neurolaw.

In this regard, it is worth considering a well-known attempt to solve the mind-brain problem, in some way recovering the autonomy of mental phenomena in the context of naturalism. We are talking about the proposal made by John Searle (1984). To save both the mind and the brain, Searle puts forward the formulation of two theses. The first thesis is the following:

> Mental phenomena, all mental phenomena whether conscious or unconscious, visual or auditory, pains, tickles, itches, thoughts, indeed, all of our mental life, are caused by processes going on in the brain (Searle, 1984, p. 18).

If the external pain stimulus were present, but it did not activate the nerve endings of the brain, it would result in the absence of pain (this is the case of anesthesia). But if the stimulation of the thalamus and the somatosensory cortex took place in the absence of real external stimuli, the sensation of pain would still

be perceptible. Mental phenomena therefore do not derive from an external object that determines them, but from modifications that occur at the cerebral level (Searle, 1984). So, what is pain, if it is not the effect of external objects on our nervous system?

Searle therefore develops the formulation of the second thesis:

> Pains and other mental phenomena just are features of the brain (and perhaps the rest of the central nervous system) (Searle, 1984, p. 19).

Mental phenomena are therefore structural and biological characteristics of the brain, as properties of the nervous system which, however, have their own autonomy. Searle's fundamental idea is to recover the concept of intentional agent through an approach he calls "biological naturalism", that is, the naturalistic solution to the mind-brain problem. If the main characteristics of mental phenomena (consciousness, intentionality, subjectivity and mental causation) are at first glance irreconcilable with a scientific conception of the world, it is equally true that this (apparent) inconsistency is due to a basic misunderstanding of the nature of mental phenomena. Indeed, the latter, whose existence in the real world is a fact for Searle, can actually be described and explained through the conceptual framework of the natural sciences, referring to the distinction, often used in physics, between micro and macrolevel, two different but related levels of description.

This is a fundamental distinction to take into consideration as to understand how complex biological systems function and which, consequently, should also be applied to the study of the brain. To better understand the importance of the micro/macro distinction, take the case of water as an example: on a micro level, it is composed of atoms and molecules, on a macro level it can be said that it is liquid. But although water is composed of atoms and molecules, these atoms and molecules cannot be said to be characterized by liquidity. Liquidity is a characteristic of the macrosystem, and not of the individual parts that make it up. In Searle's opinion, therefore, the mind-brain relationship is analogous to the relationship between the liquidity of water and the molecules and atoms that compose it on a microscopic level. Mental phenomena are caused by brain processes and, at the same time, they occur in the neural system. Thirst, which is an intentional state with its own content, is both caused by a series of brain mechanisms that take place mainly in the hypothalamus and is itself a feature of the hypothalamus. Properties on a macro level are therefore caused by those on a micro level but are not entirely reducible to the latter.

Although it has not been elaborated with reference to the law, the naturalistic solution theorized by Searle can nevertheless be a valid path to undertake as to protect the concept of intentional agency albeit within the neuroscientific framework. Indeed, on the one hand it treats mental phenomena as an integral part of nature and, on the other hand, it uses a model of explanation that is applicable both to the mind-brain relationship and to many other natural phenomena (Searle, 2004). This way, biological naturalism is consistent both with what neuroscience

currently tells us about the brain, and with some long-lasting insights of folk psychology that underlie the law. This is a radical revision of the idea of intentionality, which is no longer understood as something immaterial, but as strongly rooted in a biological state.

Now, the problem is that the mind as a material phenomenon is an entirely new concept for criminal law, which is based on the implicit assumption of mind-body (or mind-brain) quasi-dualism. In the next section we will therefore consider the possible consequences of neuroscience on the epistemological status of criminal law.

5. Epistemological issues in neurolaw

We have tried to show how two contrasting anthropological models are implicit at the basis of law, on one side, and neuroscience, on the other side. The criminal system, as we have said, is largely based on commonsense psychology (folk psychology), which takes for granted the existence of some entities (desires, beliefs, intentions) that are not directly observable. According to Stephen Morse (2011), the criminal sanction specifically:

> […] presupposes a "folk-psychological" view of the person and behavior. This psychological theory explains behavior in part by mental states such as desires, beliefs, intentions, willings and plans. Biological and other psychological and sociological variables also play a causal role, but folk psychology considers mental states fundamental to a full causal explanation and understanding of human action. Lawyers, philosophers, and scientists argue about the definition of mental states and theories of action, but that does not undermine the general claim that mental states are fundamental (Morse, 2011, pp. 598-599).

In other words, the retributivist element of criminal justice – for which an individual who commits a crime, manifesting a *mens rea*, is worthy of a criminal sanction – rests on the idea of the human being as an "agent that forms intentions, produced by desires and beliefs elaborated on a mental level, and acts on the basis of those" (Lavazza and Sammicheli, 2012, p. 77).

The anthropological model of neuroscience, however, is very different from the one implicit in law. Neuroscientific findings indicate that the idea of a human being endowed with freedom, intentional agency and liability is not actually based on solid empirical foundations, and the quasi-dualistic paradigm of law, according to which there is a mind that is able to deliberate freely regardless of what happens inside the brain, is basically illusory. Scientists know that brain processes are involved in certain mental activities; they also know that it is possible to provide a reductionist explanation of psychological states and that, to put it differently, macrolevel causal relations are reducible in some sense to microlevel causal relations.

The scientific studies conducted so far, including those relating to the Dutch case, have highlighted a strong biological component at the basis of violence: from

genes related to a greater probability of developing deviant behavior, to the role of neurotransmitters and brain development in the regulation of violent impulses (cf. Kravitz, 2000; Raine, 2014). It therefore seems justified to believe that a criminal law that does not take the slightest account of how our brain works – one that wants to operate on the basis of unchangeable conceptual frameworks regardless of neuroscientific findings – is in fact short-sighted (Di Giovine, 2018), as well as ethically questionable.

Now, separatism is the view that there cannot be a meeting point between the prescriptive dimension of the law (what ought to be) and the descriptive dimension of neuroscience (what is), choosing to maintain the conventionalist position of law by virtue of its "scientific but not juridical acceptance" (Lavazza and Sammicheli, 2012, p. 117). This perspective, however, is denied by the history of scientific thought. Advances in the natural sciences have always pushed towards a clarification of the concepts of folk psychology, showing their intrinsic limits and adapting them to a more realistic worldview. If once, in a pseudoscientific perspective, it was believed that "madmen" were people possessed by the devil who should be burned at the stake, or that criminals could be identified on the basis of their median occipital dimple, today we know that these individuals simply suffer from impaired brain functions.

It could therefore be argued that, on closer inspection, the realistic nature of science bears a value aspect and that criminal law, being part of the so-called soft sciences with a less strong epistemological status than the hard sciences, aspires to coincide as much as possible with the real description and function of the world, which includes the human being. Therefore, the relationship between science and law might be conceived from the perspective of co-production, understood as a theoretical position that gives evidence of the continuity of interaction between the descriptive dimension of science and the prescriptive dimension of law. This would also presuppose the regulative principle of truth as correspondence to facts (Di Giovine, 2018).

That said, some philosophers, psychologists, and cognitive neuroscientists (but significantly no legal scholars) propose accepting reductionism or eliminativism in a consequentialist perspective. In their opinion, we need a revolution in order to abolish the retributive element of criminal law, in favor of the more humane model of social prevention. Greene and Cohen (2004) believe that the concepts of folk psychology, such as the concept of free will and, with it, the concept of desert as delineated by the retributive theories of punishment, are now obsolete and must therefore be permanently set aside.

> There are two primary motivations for questioning retributivist theory. The first, which will not concern us here, comes from a prior commitment to a broader consequentialist moral theory. The second comes from skepticism regarding the notion of desert, grounded in a broader skepticism about the possibility of free will in a deterministic or mechanistic world (Greene and Cohen, 2004, p. 1777).

And then again:

> Free will as we ordinarily understand it is an illusion generated by our cognitive architecture. Retributivist notions of criminal responsibility ultimately depend on this illusion, and, if we are lucky, they will give way to consequentialist ones, thus radically transforming our approach to criminal justice. At this time, the law deals firmly but mercifully with individuals whose behavior is obviously the product of forces that are ultimately beyond their control. Some days, the law may treat all convicted criminals this way. That is, humanely (ibid, p. 1784).

The one expressed by Greene and Cohen is an incompatibilist version of the relationship between neuroscience and traditional legal systems, which envisages a sort of complete reconstruction of the law through active intervention policies. Pereboom and Caruso (2018), who advocate the quarantine model of criminal justice, argue with philosophical arguments that our behavior is generally beyond our control and that the basic desert according to which the law condemns wrongdoers is not justified. They propose that whoever commits a crime (and also, at least in some cases, whoever is simply judged dangerous) should not be put in jail but placed in quarantine so that they cannot harm society. Quarantine is morally justified by the analogy with what is done with carriers of communicable diseases. So that the latter do not spread the contagion, it is acceptable to confine them against their will as to protect the healthy. The same can be done with offenders, making the criminal justice system fairer and more humane.

These perspectives translate on a pragmatic level into the coincidence between criminal law with empirical facts, a coincidence that "must be pursued at all costs, 'once and for all with a few strokes of the pen', 'transferring' scientific acquisitions into criminal law" (Di Giovine, 2018, p. 13)[12]. This goal, however, comes with certain concerns. As already mentioned, neuroscientific research does not proceed in a linear way, but proceeds by trial and error, through refutations and confirmations, providing us with data that are susceptible to different and, at times, even opposite interpretations.

But the fact that neuroscience is, after all, a young science is not the only element that questions the feasibility of a radical crime justice revolution. We must also consider that we do have a retributive drive that is actually the result of our evolutionary path, firmly rooted in our biology, even though Greene and Cohen consider it essentially irrational. Kolber (2014) states, regarding this problematic aspect:

> Greene and Cohen correctly point out that we can, at least in principle, recognize biases in our decision making and overcome them in special contexts. This response raises questions, however, about the arguments supporting their prediction. The vivid neuroscience displays that are supposed to change people's minds operate more at the level of gut instinct than rational thought. Are the expert decision makers who set criminal justice policy swayed merely by vividness? If they are, why think that the vivid illustrations of neuroscience will speak to them more strongly than their deep retributive impulses?

12 Translated from Italian.

> Alternatively, if they are not swayed by gut instincts and vivid illustrations, then why expect their views to change in the future? (Kolber, 2014, p. 817).

Eliminating the retributive stance and the theoretical structure of folk psychology from criminal law is certainly a counterintuitive move. Bearing this in mind, it is worth considering a progressive interaction between science and criminal law based on a more moderate and gradual approach. We think it makes sense to endorse a kind of compatibilist approach between traditional law and neuroscience. This approach does not intend to diminish or ignore the decisive role of neuroscientific findings about the role of genes and the brain in the regulation of behavior but does not wish either for a radical rewriting of the law. According to this view, the law will change gradually and naturally following the change of widespread beliefs relating to the human mind, as neuroscientific research proceeds in its naturalistic investigation.

This position, in essence, expresses a "cautious optimism" (Morse, 2011) with regards to the impact of neuroscience on criminal justice systems. This view acknowledges the continuous interaction between science and folk psychology, where the latter pushes neuroscientists to verify their empirical correspondence, and neuroscience tends to define more precisely the conceptual framework of criminal law. It therefore seems legitimate to state that one of the tasks of criminal law should be to avoid ostracizing a science that is able to deny our common views on the human mind, without necessarily having to undergo a forced and premature revolution.

6. Conclusion

We have addressed the complex issues of juvenile justice and brain immaturity raised by the Dutch case. In this sense, the example of the Dutch juvenile law signals a potentially virtuous path towards the reception of the most recent neuroscientific evidence, but at the same time it serves as a litmus test to highlight all the difficulties and unresolved aporias that still afflict the process of bringing neuroscience into law. Firstly, as we have highlighted, there are conceptual problems that concern both ontological and epistemological aspects. These problems can be summarised in questions like these: Where do we draw the line between person-to-person variation and a serious abnormality that caused a crime to be committed? What are the parameters of an average brain? How different is an "abnormal" brain? But the most pressing question is still, can we (and how can we) understand the linear causality between a neurologic diagnosis and a related mental state and subsequent manifest behavior?

Secondly, there are technical difficulties related to neuroscience itself, to the continuous progress of knowledge and investigation techniques. These, in fact, cannot enter the courtrooms until they are widely validated, but by the time they are widely validated they already need to deal with new findings and new devices. Moreover, interpretations of neuroscientific data, which are the real test case for

the law, remain marked by broad disagreement. And all this makes it more difficult to base judicial decisions largely if not exclusively on neuroscientific evidence.

In short, much of the theoretical and pragmatic difficulties for neurolaw arise from the coexistence of different conceptual apparatuses which, at least *prima facie*, seem to constitute a conflicting relationship. The Dutch case shows a discrepancy between legal and neuroscientific maturity, between psychological maturity and cerebral maturity, revealing that our concepts of agency and moral liability provided by folk psychology are severely questioned by neuroscientific findings. Basically, the claim of the Dutch legislators to reform juvenile justice raises the basic ontological problem inherent in the relationship between mind and brain.

Neuroscientific findings give us reasons to believe that brain states are at least the necessary condition for mental states. So, the mind as viewed by folk psychology is gradually being rethought as a physical phenomenon. In this vein, we proposed to adopt Searle's theory of mind/brain as a provisional framework to give a conventionalist bridge to a more scientific approach to criminal law, without adventurous leaps and unmotivated revolutions. The path of neurolaw is going to be long and bumpy. It will eventually lead to a better legal system that is more fitting to human reality, but it will not be able to avoid the issues and questions that we have tried to illustrate in this article.

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