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Folk Psychology and Legal Understanding

ROBERT BIRMINGHAM*

I write for Hugh with admiration and affection.

Law lags science. Canon law counts as law; think of Galileo. Or, less jurisprudentially, Pius XII's endorsement of the big bang in 1951.¹ These imprudences did no *legal* damage. The gulf between law and neuroscience is arguably another matter, because here law *uses* theories of action and so forth that are manifestly false, unless, conceivably, as I will mention again later, one uses a pragmatic theory of truth. I'll approach this difficulty three ways, addressing evolutionary psychology, legal responsibility imagined at the neuronal level, and law among bacteria, in that order.

I. FOLK PSYCHOLOGY

As befits the theme rebellious leadership, I begin, although I do not tarry at, an opinion by the second Justice Marshall, who as a civil rights attorney led perhaps our greatest rebellion. The case is *Ford v. Wainwright*,² in which Marshall wrote for the Court. *Ford* resolved the question, could Florida execute an insane man? Well, of course not. So our interest resides in why not, or more particularly in the trouble Marshall had in articulating why not. Basically, he cited some legal authorities, who did not explain themselves, and then said some things like the condemned would not experience the terror of it all if he did not know what was going on. That is, Marshall had no reason.

Keep in mind that *insanity* is a legal, not a medical, concept. And that psychiatry is now a specialty of pharmacology. Then where did the concept come from? From folk psychology. But that is not quite right either; really,

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1. See HELGE KRAGH, *COSMOLOGY AND CONTROVERSY* 256-59 (1996).

2. 477 U.S. 399 (1986).

the law made up the concept, *presupposing* folk psychology. Anyway I had better define folk psychology at once.

“Folk psychology” denotes the prescientific, commonsense conceptual framework that all normally socialized humans deploy in order to comprehend, predict, explain, and manipulate the behavior of humans and the higher animals. This framework includes concepts such as *belief, desire, pain, pleasure, love, hate, joy, fear, suspicion, memory, recognition, anger, sympathy, intention*, and so forth.³

Right away by ‘prescientific’ the author acknowledges the conflict of law with science. Moreover, as lawyers, we are comfortable with folk psychological concepts, and apply them unthinkingly and promiscuously. The author’s reference to *Intention* shows that the “and so forth” admits *insanity, volition, and responsibility*.

Consider *volition*, starting at the apex of the Great Chain of Being—far from bacteria, to which we are coming. Ask yourself whether God exercises volition; and if so, what God can accomplish through this exercise. The stock response is that God can exercise volition, and that he did so to create the world *ex nihilo*. Just by saying, “Let there be light,” etc. The cash value of volition, then, is physical consequences. However, how God or anyone gets from the spiritual to the physical is a great philosophical puzzle.

Grünbaum, a philosopher of science, finds the idea of this transmutation incoherent, in the first instance because God lacks a nervous system.⁴ In the history of philosophy, however, having a nervous system has not helped much, the difficulty now being the interface between volition and the nervous system. The pineal gland, the Cartesian pathway or bottleneck, seems insufficiently broadband for such big work. Occasionalism (Malebranche) would have God interpose his volition between human mental cause and physical effect. But that just returns us to the original problem.

II. EVOLUTIONARY PSYCHOLOGY

Yet legal responsibility presupposes volition (it would not matter if strict liability offenses, such as statutory rape or owning a radioactive landfill, were exceptions; yet here too responsibility imports having willed *something*). A profession arising from, and repudiating, this presupposition is that of *mitigation expert*.⁵ It is the task of the mitigation expert to excuse

3. Paul M. Churchland, *Folk Psychology*, in PAUL M. CHURCHLAND & PATRICIA S. CHURCHLAND, *ON THE CONTRARY: CRITICAL ESSAYS 1987-1997* 3, 3 (1998).

4. See Adolf Grünbaum, *Theological Misinterpretations of Current Physical Cosmology*, (visited April 14, 2000) <http://www.skeptics.org/library/modern/adolf_grunbaum/theological.html>.

5. See *Thomas v. Gilmore*, 144 F.3d 513, 515 (7th Cir. 1998).

or explain the conduct of an offender as having been caused by events outside her control, the idea being, *de tout comprendre, c'est de tout pardonner*. Right here with the mitigation expert, while remaining broadly within the framework of folk psychology, one can begin to subvert this psychology. The field of *evolutionary psychology* exploits the fact that our brains are optimized to respond to conditions in the past of our species, rather than to modern circumstances, to which they have had insufficient time to adapt. A scurrilous product of this psychology is Thornhill and Palmer's *A Natural History of Rape*.⁶ The authors argue or at least assert, after thinking a lot about misconduct among beetles, that millennia ago rape was a viable and consequently evolutionarily selected strategy of transmission of genes; that men still carry the concomitant genetic predisposition; and that women had best beware.⁷

We read a case alongside the book to produce anomaly. The case is *Joan v. E.*, reported in the Yearbooks of Edward II for the years 1313-1314.⁸ Really there are two connected cases here, respectively civil and criminal, arising from a charge of rape committed by E., the charge made by Joan, the victim. Civil aspect first.

The record is not as transparent as it might be. Yet one can make out that the pleading is oddly defective, Joan having omitted to allege rape. The court dismisses Joan's suit on technical procedural grounds, directing that Joan be imprisoned for poor pleading. What is left undecided in *Joan v. E.* is the criminal action, rape being not only an offense against the victim, but besides, an affront to the peace and dignity of the king.

Here then is the rest of the case, as the court reporter hands it down to us. Bereford, C. J., is about to sanction E. for, as the modern rendering puts it, having "ravished the maid Joan." (A curious footnote at this point suggests that the prosecution is not serious; I do not know what to make of this footnote.) Joan is right there in court, not yet having been incarcerated. So is E in court. Joan is carrying an infant in her arms, presumably hers. *Bereford*: Who is the father? *Joan*: E. is the father. *Bereford*: Then E. is "guilty of naught." How come? Bereford recognizes lack of consent as an element of the common law offense of rape, and concomitantly believes that a woman cannot become pregnant without having consented to the sexual act.

Bereford speaks as if taking judicial notice: as though this rather esoteric biological proposition were transparent and within the common understanding, as for instance is the fact that midnight happens at night. This apparent misapprehension was not infrequent in its day, and is repeated

6. SANDY THORNHILL & CRAIG T. PALMER, *A NATURAL HISTORY OF RAPE: BIOLOGICAL BASES OF SEXUAL COERCION* (2000).

7. See *id.* at 198-99.

8. See *Joan v. E.*, in *YEARBOOKS OF EDWARD II, I THE EYRE OF KENT, 6 & 7 EDWARD II* 111 (Selden Soc'y No. 24, Frederic W. Maitland & Willaim C. Boland, eds., 1909).

(although with doubt of its truth) in Hawkins' respected *Pleas of the Crown, 1716-1721*⁹, which treatise further instructs us that rape was at common law first a felony, punishable by death, unless the victim and her attacker marry. One imagines such marriages were as happy as most. However, Hawkins goes on, the offense was later reduced to a great misdemeanor, so that the rapist lost only his eyes and his testicles. In those days the law did not fool around.

The modern legal scholar has invariably dismissed *Joan v. E.* as the monstrous progeny of misogyny and medical misunderstanding. Doubtless the consensus of scholarship would have continued thus, had Thornhill and Palmer not enlightened us. Shortly after their sensitive and valuable examination of nonconsensual sexual relations among scorpion flies, the authors write:

Human rape victims rarely show much sexual arousal and seldom achieve orgasm. It is conceivable that some aspects of women's capacity for orgasm evolved in the context of reducing the fertilizing capacity of rapists' ejaculates. That is, the absence of orgasm during rape may be an evolved response to rape.¹⁰

That is, a woman's withholding orgasm prevents, or at least, reduces the probability of, her pregnancy. Consequently, pregnancy is evidence of orgasm, and (to shape the argument up a little) orgasm is evidence of consent. If not conclusive, at least it raises a reasonable doubt, to put it anachronistically.

In the nearly blinding light of evolutionary psychology, *Joan v. E.* seems still stranger, and less misogynist than prescient. For how could Bereford, and the common law that he declared, have uncovered the connection between pregnancy and consent, by centuries anticipating Thornhill and Palmer? Recall that even the concept *paternity* is not self-evident. Yet we ought not be confounded by this prescience, the insight, if it be such, being no more peculiar than the nearly unerring efficiency of the common law, for instance respecting contract damages.

We may pursue the matter further. Is rape even possible? Sure, the actual entailing the possible. However, the argument in evolutionary psychology against there being such a thing goes like this. Transparently, the terminus ad quem of both sexes is viable grandchildren. Women who did not want this were weeded out long ago. The strategies differ between the sexes however. Whereas it pays a male in genetic transmission to father children wherever he can, the cost (ultimately in energy) to him of doing so being insignificant, a woman must invest in procreation deliberately. She

9. See WILLIAM HAWKINS, 1 A TREATISE OF THE PLEAS OF THE CROWN, 108-09 (London, 1716-1721) (2 vols.).

10. THORNHILL & PALMER, *supra* note 6, at 99.

should want as a partner whoever is best at having children, with her or anyone else. Then he will transmit his genes, and hence his proclivities, to their male children, who will also be good at procreating, leading to many grandchildren. Hence a woman, the theory goes, will put obstacles in the way of her suitors, testing them, eliminating those lacking fortitude or procreative genius. However, who better than the rapist to overcome obstacles?

Thornhill and Palmer do not endorse, or even notice, this argument. Plainly it threatens a *reductio*, one woman's *modus ponens* being another's *modus tollens*. Maybe the authors have not thought of it. Yet they neatly foreclose it. For the rapist, they argue, is not the ultimate, but the marginal, unfit reproducer—an individual unable to acquire procreative partners through the usual material incentives. (That fertility depends on prosperity is a theme that runs through the book.) In fact, the authors urge upon us, frustrated reproductive strategy, that is, preempted female breeding choice, is the source of the anguish of rape, precisely as pain signals prospective tissue damage.¹¹ A disclaimer that they properly make: To identify the source of a sensation or emotion does not challenge its reality or denigrate its intensity. Their characterization of the rapist would have to hold true of social relations, such as they were, hundreds of thousands of years ago, as gradually we evolved our tastes and proclivities. The authors are comfortable that it does.

3. *Physiology*

Consider then a minireview that appeared not long ago in *Neuron*,¹² as being unsettling in light of legal interpretations of responsibility. Its authors, Leon and Shadlen, recite the significance of decisions about the sensory world. I.e. incorrect decisions can get us killed. Manifestly however they did not get any of our ancestors killed, at least not prior to their reproductive exploits. Leon and Shadlen start with a definition: "Th[e] nonreflexive linkage between sensory input and behavior involves interpretation and behavioral selection, what we refer to as a decision process."¹³ This makes sense. The language 'nonreflexive' implicates *intent*. It is these decisions, or more properly their behavioral consequences, that as attorneys we assess, and to which we assign legal responsibility.

The authors report upon behaving monkeys, chimpanzees being prohibitively expensive, mice being insufficiently nonreflexive, it being impractical or impolitic to implant recording electrodes in the heads of human subjects. Typically, an experimenter provides a monkey with a visual stimulus, to which the monkey indicates a direction (left or right). The in-

11. See *id.* at 100-03.

12. See Matthew I. Leon & Michael N. Shadlen, *Exploring the Neurophysiology of Decisions*, 21 NEURON 669 (1998).

13. *Id.* at 669.

centive for the choice is a sip of water or something. Often there is a region of equivocal stimuli, within which the monkey with some significant probability chooses either direction. Patterns of neuronal activity to identical stimuli in sensory areas of the cortexes of these monkeys predict how they will choose. Nevertheless, these sensory neurons are not good general decision neurons, the authors tell us. The neurons are largely silent without sensory input, although deciding can continue past its stopping.

Conversely, particular neurons at the sensory-motor interface, often firing with delays, appear to encode both sensory and motor properties, and are increasingly often proposed as loci of decisions. With few exceptions, relevant experiments so far have observed monkeys committing themselves immediately upon presentation of the stimuli. Thus one can watch them behave, but not see them ponder. Leon and Shadlen have presented equivocal, threshold stimuli that are less straightforwardly resolved into behavior. The posterior parietal cortex turns out to be a locus of decision in the sense that differential activities of its cells predict behavior (perhaps a shift of gaze to right or left) seconds before eye movements.

The authors conclude that these latter studies "provide the most compelling evidence yet for a neural correlate of a decision mechanism."¹⁴ What do they mean by "correlate"? I.e. is not the decision mechanism the activities of the neurons themselves? There appears not to be a *nonneuro-nal* level of deciding above these activities. Their language I interpret as scientific reticence.

So this is the underlying science. Now let us shift closer to law. A novel, *Brain Storm* by Richard Dooling,¹⁵ an attorney, expresses this science in the popular idiom, amid moments of its characters' extravagant passion. Here is a didactic interlude:

So the narrative which most accurately represents the neuroscientific sequence of shooting a man goes like this. One, a burst of neural activity in the motor cortex initiates movement by sending a message to the trigger finger. Two, after three hundred milliseconds, the individual becomes subjectively aware that an impulse to kill has originated somewhere in his brain, and that a signal is being sent to his trigger finger. Three, during the two hundred to two hundred fifty milliseconds after awareness and before actual movement occurs, other parts of the brain decide whether to interfere with or counteract that signal, which was launched pre-consciously, almost half a second before. Four, the brain either stops the action, or allows the trigger finger to move.¹⁶

14. *Id.* at 671.

15. See RICHARD DOOLING, *BRAIN STORM* (1998).

16. *Id.* at 119-20.

But now we may discard consciousness as epiphenomenal: no evident guiding intelligence resides above the hundred billion neurons, their trillions of connections; nothing that decides or ratifies an otherwise purely neuronal undertaking; only neurons modulating the activity of other neurons. All is atoms and the void.

Then concepts like *blame* and *responsibility* are ungrounded, it being unconvincing to assign blame by neuronal discharge. Nor are neurons the end of it, because a neuron contains a billion proteins, themselves behaving intricately.

IV. THE PRISONER'S DILEMMA DOWN THE GREAT CHAIN OF BEING

We may want grandchildren, yet implement this goal with such indirection that it is not visible at all. That is what is nice about synthetic a priori propositions. One may hold them without empirical support. Indefiniteness of terms hinders an effort to distinguish our species through the intricacy and sophistication of this indirection. But beyond this, any such sophistication has its counterparts among lesser players.

		B	
		~C	C
A	~C	1	0
	C	10	6
		0	6

Figure 1. Prisoner's Dilemma

At least since Hobbes, a jurisprudential tradition has measured law by its ability to resolve the prisoner's dilemma.¹⁷ I show that nematodes and viruses play the prisoner's dilemma, but curiously that bacteria do not. Given the Hobbesian criterion, and the requisite suspension of disbelief, societies of bacteria are candidates for possessing a legal order.

The prisoner's dilemma is a game—in a technical mathematical sense—whose heuristic narrative is as follows. Two prisoners, A and B, are charged with a felony, for instance robbing a bank. Separately they must choose to confess or not confess. The payoffs are: if both confess, each serves five years; if neither confesses, each serves one year (from convic-

17. See DAVID GAUTHIER, *MORALS BY AGREEMENT* (1987).

tion on a lesser weapons charge, or as the risk-neutral expected loss from trial on the robbery charge with a probability of conviction of 1/6); if one prisoner confesses and the other does not, the prisoner who confesses goes free, while the other serves ten years. Figure 1 shows the game.

The game has a solution, i.e. a Nash equilibrium. A Nash equilibrium, named for the Nobel Laureate John Nash, who discovered it, is a set of choices such that no prisoner can increase her payoff by changing her choice unilaterally. This set of choices is that both prisoners confess, with each prisoner serving six years. Starting from this set of choices, either player serves four additional years by changing her choice.

Yet both prisoners confessing is the sole outcome—the single set of payoffs—that is not Pareto optimal. A set of payoffs is Pareto optimal if it is not possible to shift to another set so as to increase the utility of one player without decreasing that of the other. In the prisoner's dilemma, a shift to neither prisoner confessing reduces the sentence of each prisoner by five years.

The analysis assumes that years served is a satisfactory surrogate for utility; that the prisoners cannot contract (that is, that between or among themselves they are in a state of nature); and that they do not love each other, in the economist's sense of love: having interdependent utility functions. It does not assume that the prisoners have committed the offense, for the game is adequately described without alluding to this.

Each participant is better off confessing whatever the other does, so knowledge of what the other will do has no bearing on one's choice, as opposed to the payoff from that choice. Nor does trust have anything to do with the game: were one prisoner to trust the other not to confess, she would confess nonetheless, happy that she goes free. An expected result is that each prisoner swears steadfastness, then both rat out.

The game is not trivial. At least one philosopher, David Gauthier, has spent his professional life, and risen to prominence, reflecting on this game. We play it incessantly: law enforcement relies on it; arms races and cheating on oil quotas are instances of it; professors force its play upon their students. Here however we treat play among lesser creatures. We will be treating games with n players (in the game as stated, $n = 2$).

The legal opportunity will be with bacteria. Therefore let us bracket them biologically, by nematodes on one side and by viruses on the other. Nematodes are worms, thus multicellular. Viruses are intracellular parasites — DNA or RNA having protein coats. Bacteria are cells. Nematodes and viruses play similarly, so that a single description of their play nearly suffices for both. Following Herre,¹⁸ I describe that of nematodes of the genus *Parasitodiplogaster*.

18. See E. Allen Herre, *Population Structure and the Evolution of Virulence in Nematode Parasites of Fig Wasps*, 259 SCIENCE 1442-45 (1993).

Herre studied eleven species of *Parasitodiplogaster* native to Panama. Each species parasitizes a distinct species of wasp. Each species of wasp pollinates, and reproduces inside the synconia of, a distinct species of fig. The wasp and nematode life cycles are as follows: Gravid, pollen-bearing foundress wasps penetrate the figs, pollinate them, lay eggs, and perish. Their issue eclose and mate inside the fig, the females departing to repeat the cycle. Six or seven nematodes enter a fig with an infected foundress wasp. They feed on the wasp, mate, and die. Their issue hatch as the young wasps eclose, attach themselves to these wasps, and accompany them to other figs.

The wasps differ by species in the probability, p , that their figs contain other foundress wasps, hence eventually infant wasps of multiple mothers. The virulence, v , of a parasite is the proportion of its host's resources it appropriates, a proxy for which is how much the parasite curtails its host's fertility. This is a good proxy because, remember, the bottom line in resource use is how many grandchildren one leaves.

Across the species of nematodes studied, virulence correlates with the probability of multiple broods within the figs of the species wasps they parasitize, as shown in the table below. Fitting by least squares gives the equation:

$$v = 0.183873p + 0.00471197.$$

Nematode Virulence		
Species	Proportion of Multiple Broods	Virulence
columbrinema	0.01	-0.01
performema	0.01	0.03
paranema	0.08	0.00
pertanema	0.10	0.01
oblusinema	0.17	0.06
bullenema	0.18	0.01
citrenema	0.22	0.07
tyopenema	0.42	0.08
nympanema	0.45	0.10
trinema	0.69	0.16
popenema	0.76	0.11

Think of a wasp as passive, while its nematode decides the proportion of the resources of the wasp it appropriates. This proportion ranging from zero, indicating that on balance it pays back what it takes from the wasp, as it must if only one wasp occupies a fig, as noted below; to one, which indicates that the resources of the wasp make only infant nematodes.

The higher the proportion of resources that a nematode appropriates, the more infant nematodes it makes, at the cost of making fewer infant wasps. A nematode, to transmit its DNA, needs both infant nematodes and infant wasps; yet except in the limit case of one wasp per fig, only the

nematodes, i.e. not the wasps, need be the nematode's own. Imagine such a simple case first, that is, a case with one wasp per fig, and additionally, merely to keep the mathematics transparent, one nematode per wasp. The fates of the descendants of wasps and nematodes are then inextricably connected; and the equilibrium virulence is 0, lest the wasp be selectively disadvantaged, and the DNA of the nematode and that of the wasp become extinct together. (At this moment, one should reflect briefly upon the simultaneous extinction of the passenger pigeon and the passenger pigeon louse).

Because a wasp lacking a nematode and a nematode lacking a wasp are equally improvident for a mother nematode, she optimizes by making the same number of both. Now drop the assumption of just one wasp per fig. Intuitively, optimal virulence increases, because the issue of a nematode can parasitize the issue of wasps other than that it infects. So she should concentrate on making nematodes, letting the neighboring nematodes make the wasps.

If the situation is evolutionarily stable, however, all the nematodes of a particular species do the same thing; and stability implies a Nash equilibrium, so that no nematode can advance its DNA by altering its behavior, the behavior of the other nematodes in the fig being unchanged. Again intuitively, the nematode will make nematodes until gain from the marginal nematode equals the marginal cost in infant wasps.

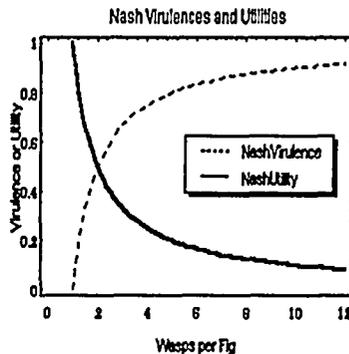
A *Mathematica* program that consolidates and extends the observed (and expected) behavior, written in terms of wasps per fig rather than probabilities, is as follows:

```
virulenceList :=
Table[virulence[i], {i, 1, 20}];

nashVirulence[n_] :=
Solve[Join[Table
[marginalUtility[i, n] == 0, {i, 1, n}],
Table[virulenceList[[1]] ==
virulenceList[[i]], {i, 2, n}]],
Table[virulenceList[[i]], {i, 1, n}]]
//Flatten // First // Last

nashVirulenceList[n_] :=
Table[nashVirulence[i], {i, 2, n}]

nashVirulenceListPlot[n_] :=
ListPlot[nashVirulenceList[n]]
```



The accompanying figure states the dependence of virulence upon multiple broods as given by this program. What is happening is straight-

forward. As the number of wasps per fig increases, each nematode appropriates more of the resources of the wasp it parasitizes to make nematodes with its DNA. And with each nematode behaving thus, collectively the wasps are overexploited, so that the utility of each nematode diminishes. So does the utility of the wasps; but we will see that this decline of utility of the host is not universal.

Now the virus (phage), for which the prisoner's dilemma lies on the surface of recent scientific literature, so that we need not find the game ourselves.¹⁹ The game plays out parallel with those among nematodes. The phage release and sequester diffusible products within an invaded cell. Familiarly, Turner and Chao measure viral fitness by reproductive ability. As the intracellular viral load increases, the quantity released by each viral particle declines, becoming increasingly suboptimal, in terms of this fitness, consonant with the practice of nematodes. Turner and Chao gloss this conduct as selfishness; however, we do not, because to do so is folk psychology; and because, tautologically, everything acts in its own interest.

We move now to bacteria, and naïvely interpolate. A bacterium is a subtle cell, hence must have evolved, as have we all, to play the prisoner's dilemma. Additionally, the basis of this play is evident: bacteria release virulence factors, which interfere with cellular and systemic functions of their hosts. The purpose of this release is not to harm their hosts per se, but to benefit themselves. Again by our calculation, release of virulence factors will decline disproportionately as bacterial concentration increases.

Remarkably and engagingly, virulence factors among the bacteria do not decline. So we are doing real science, defined as proposing and testing hypotheses. Moreover, it has only recently been seen to be false. Let me tell the story briefly, it being too good to hold back. My exposition follows that of Evelyn Strauss.²⁰

Appreciation of this bacterial behavior began in the 1960s with the discovery of bioluminescence in *V. fischeri*. These bacteria, when sufficiently concentrated, emit light. Their doing so helps the fish they live with through preventing these fish from casting a shadow on the sea bottom in moonlight. They evolved to do this, evidently, to protect their host. How much light each bacterium emits, however, is not only a function of the bacterial density (which from our analysis we expect) but a *positive* function of this density (which assuredly we did not expect). And not only a positive function, but not linear at all, as we will see. In the case of *V. fischeri*, the bacteria release the small molecule acylated homoserine lactone (acyl-HSL). So an enzyme, LuxI, makes this molecule. And the acyl-HSL upregulates a second protein, LuxR. But not in a linear way. Nothing

19. See Martin A. Nowak & Karl Sigmund, Phage-Lift for Game Theory, 398 *Nature* 367-68 (1999); Paul E. Turner & Lin Chao, Prisoner's Dilemma in an RNA Virus, 398 *Nature* 441-43 (1999).

20. See Evelyn Strauss, *A Symphony of Bacterial Voices*, 284 *SCIENCE* 1302 (1999).

much happens until acyl-HSL reaches a certain concentration. Then LuxR suddenly goes nuts. At first thought exceptional, the effect, called 'quorum sensing', has in the 1990s been found in one form or another pretty much wherever bacteriologists look.

But really things are not that bad, as follows. As I said, the field of quorum sensing by bacteria is new. Its scientists are much taken with the wonder that there is such an effect as quorum sensing – that bacteria are that smart. And they *merely speculate* about what motivates the bacteria to do such a thing. As reported by Strauss:

One reason bacteria might want to intercept their neighbors' messages [Leland S. Pierson III] says, is that "a large amount of signal suggest that other bacteria are growing and happy. That tells the bacteria that this is a great place to be." Another is competition. As Pierson [an agricultural bacteriologist, if there is such a specialty] puts it, "a plant root is not Club Med. There are limited nutrients, and a bacterium needs to know who else is there so it can make decisions about how to expend energy and succeed in that environment." In *P. aureofaciens*'s case, this means making antibiotics to inhibit the growth of competing organisms.²¹

Now the attorney can live with this, because it is disarmingly naïve. Each reason that Pierson supplies for a bacterium to want to receive a message is equally a reason for a bacterium not to want to send a message. Lots of bacteria might be listening, but none would speak. In the longer run, none would listen either. On the other hand, bacteria appear to have evolved a legal system, by our criterion. Which probably says something about our criterion.

The upshot of all this is an evident similarity between legal and lesser behavior, which suggests their assimilation. No one wants to attribute responsibility to a bacterium, much less contemplate its insanity. But maybe one does not want to do this for us either; at least not unreflectively, whatever this reflection amounts to.

V. CONCLUSION

So there you have it. How can an individual be blamed for her genetic constitution? For the behavior of her neurons? Is a bacterium less responsible? Folk psychology is false. The law is built on it. Well, many falsehoods are useful; the test is not whether a belief is true, but whether it works, if these criteria differ. However, does the law work? And having bitten into the neuroscientific apple, can we go back to the Garden as though nothing has happened?

21. *Id.* at 1304.