

Nomic: A Self-Modifying Game Based on Reflexivity in Law

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IN his excellent book *A Profile of Mathematical Logic*, the philosopher Howard DeLong tells the following classic story of ancient Greece. "Protagoras had contracted to teach Euathlus rhetoric so that he could become a lawyer. Euathlus initially paid only half of the large fee, and they agreed that the second installment should be paid after Euathlus had won his first case in court. Euathlus, however, delayed going into practice for quite some time. Protagoras, worrying about his reputation as well as wanting the money, decided to sue. In court Protagoras argued:

Euathlus maintains he should not pay me but this is absurd. For suppose he wins this case. Since this is his maiden appearance in court he then ought to pay me because he won his first case. On the other hand, suppose he loses his case. Then he ought to pay me by the judgment of the court. Since he must either win or lose the case he must pay me.

Euathlus had been a good student and was able to answer Protagoras' argument with a similar one of his own:

Protagoras maintains that I should pay him but it is this which is absurd. For suppose he wins this case. Since I will not have won my first case I do not need to pay him according to our agreement. On the other hand, suppose he loses the case. Then I do not have to pay him by judgment of the court. Since he must either win or lose I do not have to pay him."

Then DeLong adds, "It is clear that to straighten out such puzzles one has to inquire into general procedures of argument." Actually, to many people, it is not at all clear that *general* procedures of argument will need scrutiny—quite the contrary. To many people, paradoxes such as this one appear to be mere pimples or blemishes on the face of the law, which can be removed by simple cosmetic surgery. Similarly, many people who take

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theology seriously think that paradoxical questions about omnipotence, such as "Can God make a stone so heavy that It cannot lift it?", are just childish riddles, not serious theological dilemmas, and can be resolved in a definitive and easy way. Throughout history, simplistic or patchwork remedies have been proposed for all kinds of dilemmas created by loops of this sort. Bertrand Russell's theory of types is a famous example in logic. But the dreaded loops just won't go away that easily, however, as Russell found out. Wherever they occur, they are deep and pervasive, and attempts to unravel them lead down unexpected pathways.

In fact, reflexivity dilemmas of the Protagoras-vs.-Euathlus type and problems of conflicting omnipotence crop up with astonishing regularity in the down-to-earth discipline of law. Yet until recently, their central importance in defining the nature of law has been little noticed. In the past few years, only a handful of specialized papers on the subject have appeared in law journals and philosophy journals.

It was with surprise and delight, therefore, that I learned that an entire book on the role of reflexivity in law was in preparation. I first received word of it—"The Paradox of Self-Amendment: A Study of Logic, Law, Omnipotence, and Change"—in a letter from its author, Peter Suber, who identified himself as a philosophy Ph.D. and lawyer now teaching philosophy at Earlham College in Richmond, Indiana. He hopes "The Paradox of Self-Amendment" will be out soon.

In correspondence with Suber, I have found out that he has an even more ambitious book in the works, tentatively titled "The Anatomy of Reflexivity", which is a study of reflexivity in its broadest sense, encompassing, as he says, "the self-reference of signs, the self-applicability of principles, the self-justification and self-refutation of propositions and inferences, the self-creation and self-destruction of legal and logical entities, the self-limitation and self-augmentation of powers, circular reasoning, circular causation, vicious and benign circles, feedback systems, mutual dependency, reciprocity, and organic form."

In his original letter to me, Suber not only gave a number of interesting examples of self-reference in law but also presented a game he calls *Nomic* (from the Greek νόμος (nómos), meaning "law") which is presented in an appendix to *The Paradox of Self-Amendment*. I found reading the rules of *Nomic* to be a mind-opening experience. Much of this article will be devoted to *Nomic*, but before we tackle the game itself, I would like to set the stage by mentioning some other examples of reflexivity in the political arena.

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My friend Scott Buresh, himself a lawyer, described the following perplexing hypothetical dilemma, which he first heard posed in a class on constitutional law. What if Congress passes a law saying that henceforth all determinations by the Supreme Court shall be made by a 6-3 majority

(rather than a simple 5-4 majority, as is currently the case)? Imagine that this law is challenged in a court case that eventually makes its way up to the Supreme Court itself, and that the Supreme Court rules that the law is unconstitutional—and needless to say the ruling is by a 5-4 majority. What happens? This is a classic paradox of the separation of powers and it was nearly played out, in a minor variation, during the Watergate era, when President Nixon threatened he would obey a Supreme Court ruling to turn over his tapes only if it were “definitive”, which presumably meant something like a unanimous decision.

It is interesting to note that conservatives are now trying to limit the jurisdiction of the Supreme Court over issues such as abortion and prayer in the schools. Constitutional scholars expect that a showdown might ensue if Congress passes such a statute and the Supreme Court is asked to review its constitutionality.

Conflicts that enmesh the Supreme Court with itself can arise in less flashy ways. Suppose the Supreme Court proposes to build an annex in an area that environmentalists want to protect. The environmentalists take their case to court, and it gets blown up into a large affair that eventually reaches the level of the Supreme Court. What happens? Clearly the reason this kind of thing cannot be prevented is that any court is itself a part of society, with buildings, employees, contracts, and so on. And since the law deals with things of this kind, no court at any level can guarantee that it will never get ensnared in legal problems.

If self-ensnaredness is a rare event for the Supreme Court, it is not so rare for other arms of government. An interesting case came up recently in San Francisco. There had been a large number of complaints about the way the police department was handling cases, and so an introverted “Internal Affairs Bureau” was set up to look into such matters as police brutality. But then, inevitably, complaints arose that the Internal Affairs Bureau was whitewashing its findings, and so Mayor Dianne Feinstein set up a doubly-introverted committee, again internal to the police department, to investigate the performance of the Internal Affairs Bureau. The last I heard was that the report of this committee was unfavorable. What finally resulted I do not know.

Parliamentary procedure too can lead to the most tangled of situations. For example, there are several editions of *Robert's Rules of Order*, and a body must choose which set of rules will govern its deliberations. The latest edition of *Robert's Rules* states that if no specific edition is chosen as the governing one, then the most recent issue holds. A problem arises, though, if one hasn't adopted the latest edition, since one cannot then rely on its authority to tell one to rely on it.

In some ways, parliamentary procedure, which deals with how to handle simultaneous and competing claims for attention, bears a remarkable resemblance to the way a large computer system must manage its own internal affairs. Within such a system, there is always a program called an

operating system with a part called the *scheduling algorithm*, which weighs priorities and decides which activity will proceed next. In a “multiprocessing” system, this means determining which activity gets the next “time slice” (lasting for anywhere from a millisecond to a few seconds, or possibly even for an unlimited time, depending on the activity's priority and numerous other factors). But there are also *interrupts* that come and interfere with—oops, just a moment, my telephone's ringing. Be right back. There. Sorry we were disturbed. Someone wanted to sell me a telephone-answering system. Now what would—ah, ah, just a sec—ah-choo!—sorry—what would I do with one of those things? Now where was I? Oh, yes—interrupts. Well, in a way they are like telephone calls that take the store clerk away from you, annoying you in the extreme, since you have come to the store in person, whereas the telephone caller has been lazy and yet is given higher priority.

A good scheduling algorithm strives to be equitable, but all kinds of conflicts can arise, in which interrupts interrupt interrupts and are then themselves interrupted. Moreover, the scheduler has to be able to run its own internal decision-making programs with high priority, yet not so high a priority that nothing else ever runs. Sometimes the internal and external priorities can become so tangled that the entire system begins to “thrash”. This is the term used to describe a situation where the operating system is spending most of its time bogged down in “introverted” computation, deciding what it should spend its time doing. Needless to say, during periods of thrashing, very little “real” computation gets done. It sounds quite like the cognitive state a person can get into when too many factors are weighing down all at once and the slightest thought on any topic seems to trigger a rash of paradoxical dilemmas from which there is no escape. Sometimes the only solution is to go to sleep, and let the paradoxes somehow drift away into a better perspective.

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Operating systems and courts of law cannot, unfortunately, go to sleep. Their snarls are very real, and some means of dealing with them has to be invented. It was considerations such as this that led Peter Suber to invent his tangled game of Nomic.

He writes that he was struck by the oft-heard cynicism that “Government is just a game.” Now, one essential activity of government is law-making, so if it is a game, then it is a game in which changing the laws (or rules) is a move. Moreover, some rules are needed to structure the process of changing the rules. Yet no legal system seems to have any rules that are absolutely immune to legal change. Suber's main aim, he wrote, was “to make a playable game that models this particular situation. But whereas governments are at any given moment pushed in various directions in their rule-changing by historical realities and the ideology of their people and

existing rules, I wanted the game to start with as 'clean' an initial set of rules as possible." Nomic is such a game, and its rules (or rather, its Initial Set of rules) will be presented below. Most of the following description is in essence by Suber himself. I have simply interspersed some of my own observations.

In legal systems, statutes are the paradigmatic rules. Statutes are made by a rule-governed process that is itself partly statutory; hence the power to make and change statutes can reach some of the rules governing the process itself. Most of the rules, however, that govern the making of statutes are constitutional and are therefore beyond the reach of the power they govern. For instance, Congress may change its parliamentary rules and its committee structure, and it may bind its future action by its past action, but it cannot, through mere statutes, alter the fact that a two-thirds "supermajority" is needed to override an executive veto, nor can it abolish or circumvent one of its houses, start a tax bill in the Senate, or even delegate too much of its power to experts.

Although statutes cannot affect constitutional rules, the latter can affect the former. This is an important difference of logical priority. When there is a conflict between rules of different types, the constitutional rules always prevail. This *logical* level-distinction is matched by a *political* level-distinction—namely, that the logically prior (constitutional) rules are more difficult to amend than the logically posterior (statutory) rules.

It is no coincidence that logically prior laws are harder to amend. One purpose of making some rules more difficult to change than others is to prevent a brief wave of fanaticism from undoing decades or even centuries of progress. This could be called "self-paternalism": a deliberate retreat from democratic principles, although one chosen for the sake of preserving democracy. It is our chosen insurance against our anticipated weak moments. But that purpose will not be met unless the two-tier (or multi-tier) system also creates a logical hierarchy in which the less mutable rules take logical priority over the more mutable rules; otherwise, the more mutable rules could by themselves undo the deeper and more abstract principles on which the whole system is based. If supermajorities and the concurrence of many bodies are necessary to protect the foundations of the system from hasty change, that protective purpose is frustrated if those foundations are reachable by rules requiring merely a simple majority of one legislature.

Although all the rules in the American system are mutable, it is convenient to refer to the less mutable constitutional rules as *immutable*, and to the more mutable rules below them in the hierarchy as *mutable*. The same is true in Nomic, where, at least initially, no rule is literally immutable. If Nomic's self-paternalism is to be effective, then, its "immutable" rules, in addition to resisting easy amendment, must possess logical priority.

Many designs could satisfy this requirement. Nomic has adopted a simple two-tiered system, modeled to some extent on the U.S. Constitution. In principle, a system could have any number of degrees of difficulty in the

amendment of rules. For instance, Class *A* rules, the hardest to amend, could require unanimity of a central body and the unanimous concurrence of all regional bodies. Class *B* rules could require 90 percent supermajorities, Class *C* rules 80 percent supermajorities, and so on. The number of such categories could be indefinitely large.

Indeed, if appropriate qualifications are made for the informality of custom and etiquette, a strong argument could be made that normal social life is just such a system of indefinite tiers. Near the top of the "difficult" end of the series of rules are actual laws, rising through case precedents, regulations, and statutes, all the way up to constitutional rules. At the bottom of the scale are rules of personal behavior that individuals can amend unilaterally without incurring disapprobation or censure. Above these are rules for which amendment is increasingly costly, starting with costs on the order of furrowed brows and clucked tongues, and passing through indignant blows and vengeful homicide.

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In any case, for the sake of simplicity and to make it easier to learn and play, Nomic is a clean two-tier system rather than a nuanced or multi-tier system like the U.S. Government, with its intermediate and substatutory levels such as parliamentary rules, administrative regulations, joint resolutions, treaties, executive agreements, higher and lower court decisions, state practice, judicial rules of procedure and evidence, executive orders, canons of professional responsibility, evidentiary presumptions, standards of reasonableness, rules establishing priority among rules, canons of interpretation, contractual rules, and so on. This is not to say that nuanced, intermediate levels may not arise in Nomic through game custom and tacit understandings. In fact, the nature of the game allows players to add new tiers by explicit amendment as they see fit, and one reason for making Nomic simple initially is that it is easier to add tiers to a simple game than it is to subtract them from a complex one.

Nomic's two-tier system embodies the same self-paternalistic elements as does the Federal Constitution. The "immutable" rules govern more basic processes than the "mutable" ones do, and thus shield them from hasty change. Since, in the course of play, the central core of the game may change (and the minor aspects *must* change), after a few rounds the game being played by the players may in a certain sense be different from the one they were playing when they started. Yet needless to say, whatever results from compliance with the rules is, by definition, the game Nomic. The "feel" of the game may change drastically even as, at a deeper level, the game remains the same.

In a similar way, human beings undergo constant development and self-modification, and yet continue to be convinced that it makes sense to refer, via such words as "I", to an underlying stable entity. The more

immediately perceptible patterns change, whereas deeper and more hidden patterns remain the same. From birth to maturity to death, however, the changes can be so radical that one may sometimes feel that in a single lifetime one is several different people. Similarly, in law, many have acknowledged that an amendment clause (a clause defining how a constitution may be amended)—even a clause limited to piecemeal amendment—could, through repeated application, create a fundamentally new constitution.

The fact that Nomic has more than one tier prevents the logical foundation of the game—the central core—from changing radically in just a few moves. Such continuity is a virtue both of games and of governments, but players of Nomic have an advantage over citizens in that, whenever they are so motivated, they can adjust the degree of continuity and the rate of change rather quickly, using their wits, whereas in real life the mechanisms by which such change could be effected are barely known and partially beyond reach.

Standard games possess the continuity of unchanging rules, or at least of rules that change only between games, not during them. Nomic's continuity is more like that of a legal system than that of a standard game: it is a rule-governed set of systems, directives, and processes undergoing constant rule-governed change. If, however, one wants a specific entity to point to as being "Nomic itself", the Initial Set of rules, as presented below, will do. Yet Nomic is equally the product, at any given moment, of the dynamic rule-governed change of the Initial Set. The continuing identity of the game, like that of a nation or person, is due to the fact (if fact it is) that all change is the product of existing rules properly applied, and that no change is revolutionary. (One could even argue that revolutionary change is just more of the same: In a revolution, rules that have been assumed to be totally immutable simply are rendered mutable by other rules that are more deeply immutable, but that previously had been taken for granted and hence had been invisible, or tacit.)

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In its Rule 212, Nomic includes provision for subjective *judgment* (as in a court of law), not merely to imitate government in yet another aspect, but for the same reasons that compel government itself to make provisions for judgment: rules will inevitably be made that are ambiguous, inconsistent, or incomplete, or that require application to individual circumstance. "Play" must not be interrupted; therefore some agency must be empowered to make an authoritative and final determination so that play can continue.

Judgments in Nomic are not bound by rules of precedent, since that would require a daunting amount of record-keeping for each game. But the doctrine of *stare decisis* (namely, that precedents should be followed) may be imposed at the players' option, or it may arise without explicit amendment,

as successive judges feel impelled to treat "similarly situated" persons "similarly". (Admittedly, the meanings of these terms in specific cases may well require further levels of judgment. This fact is one of the most dangerous sources of potential infinite regress in real court cases.) Without *stare decisis*, the players are constrained to draft their rules carefully, make thoughtful adjudications, overrule poor judgments, and amend defective rules. This is one way Nomic teaches basic principles and exigencies of law, even as it vastly simplifies.

The Initial Set must be short and simple enough to encourage play, yet long and complex enough to cover contingencies likely to arise before the players get around to providing for them in a rule, and to prevent any single rule change from disturbing the continuity of the game. Whether the Initial Set presented below satisfies these competing interests is left to players to judge.

One contingency deliberately left to the players to resolve is what to do about violations of the rules. The players must also decide whether old violations are protected by a statute of limitations or whether they may still be punished or nullified. Whether the likelihood of compliance and the discretionary power of the judge suffice to deal with a crisis of confidence or to delay it until a rule can take over, and whether in other respects the Initial Set satisfactorily balances the competing interests of simplicity and complexity, can best be determined by playing the game.

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Nomic affords a curious twist on one common and fundamental property of games: it allows the blurring of the distinction between *constitutive rules* and *rules of skill*—that is, between rules that define lawful play and those that define artful play. In other words, in Nomic there is a blurring between the permissible and the optimal.

Most games do not embrace non-play, and do not become paradoxical by seeming to. Interestingly, however, children often invent games that provide game penalties for declining to play, or that incorporate or extend game jurisdiction to all of "real life", and end only when the children tire of the game or forget they are playing. ("Daddy, Daddy, come play a new game we invented!" "No, sweetheart, I'm reading." "That's ten points!") Nomic carries this principle to an extreme. A game of Nomic can embrace anything at the vote of the players. The line between play and non-play may shift at each turn, or it may apparently be eliminated. Players may be governed by the game when they think they are between games or when they think they have quit.

For most games, there is an infallible decision procedure to determine the legality of a move. In Nomic, by contrast, situations may easily arise where it is very hard to determine whether or not a move is legal. Moreover, paradoxes can arise in Nomic that paralyze judgment. Occasionally this will

be due to the poor drafting of a rule, but it may also arise from a rule that is unambiguous but mischievous. The variety of such paradoxes is truly impossible to anticipate. Rule 213, nonetheless, is designed to cope with them as well as possible without cluttering the Initial Set with too many legalistic qualifications. Note that Rule 213 allows a wily player to create a paradox, get it passed (if the rule seems innocent enough to the other players), and thereby win.

So much for a general prologue to the game itself. Now we can move on to a description of how a game of Nomic is played. To reiterate, Nomic is a game in which changing the rules is a move. Two can play, but having three or more makes for a better game. The gist of Nomic is to be found in Rule 202, which should be read first. Players will need paper and pencil, and (at least at the outset!) one die. Instead of sheets of paper, players may find it easier to use a set of index cards. All new rules and amendments are to be written down. How the rules are positioned on paper or on the table can indicate which ones are currently immutable and which ones are mutable. Amendments can be placed on top of or next to the rules they amend. Inoperative rules may simply be deleted. Alternatively, for more complex games, players may prefer to transcribe into their own notebooks the text of each new rule or amendment and to keep a separate list, by number, of the rules still in effect. Ideally, perhaps, all rules should be entered in a computer, with a terminal for each player; amendments could then be incorporated instantly into the main text, with a corresponding adjustment to the numerical order.

Initial Set of Rules of Nomic

I. Immutable Rules

101. All players must always abide by all the rules then in effect, in the form in which they are then in effect. The rules in the Initial Set are in effect whenever a game begins. The Initial Set consists of Rules 101–116 (immutable) and 201–213 (mutable).
102. Initially, rules in the 100's are immutable and rules in the 200's are mutable. Rules subsequently enacted or transmuted (*i.e.*, changed from immutable to mutable or vice versa) may be immutable or mutable regardless of their numbers, and rules in the Initial Set may be transmuted regardless of their numbers.
103. A rule change is any of the following: (1) the enactment, repeal, or amendment of a mutable rule; (2) the enactment, repeal, or amendment of an amendment, or (3) the transmutation of an immutable rule into a mutable rule, or vice versa. (Note: This definition implies that, at least initially, all new rules are mutable. Immutable rules, as long as they are immutable, may not be amended or repealed; mutable rules, as long as they are mutable, may be amended or repealed. No rule is absolutely immune to change.)
104. All rule changes proposed in the proper way shall be voted on. They will be adopted if and only if they receive the required number of votes.

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105. Every player is an eligible voter. Every eligible voter must participate in every vote on rule changes.
106. Any proposed rule change must be written down before it is voted on: If adopted, it must guide play in the form in which it was voted on.
107. No rule change may take effect earlier than the moment of the completion of the vote that adopted it, even if its wording explicitly states otherwise. No rule change may have retroactive application.
108. Each proposed rule change shall be given a rank-order number (ordinal number) for reference. The numbers shall begin with 301, and each rule change proposed in the proper way shall receive the next successive integer, whether or not the proposal is adopted.
If a rule is repealed and then re-enacted, it receives the ordinal number of the proposal to re-enact it. If a rule is amended or transmuted, it receives the ordinal number of the proposal to amend or transmute it. If an amendment is amended or repealed, the entire rule of which it is a part receives the ordinal number of the proposal to amend or repeal the amendment.
109. Rule changes that transmute immutable rules into mutable rules may be adopted if and only if the vote is unanimous among the eligible voters.
110. Mutable rules that are inconsistent in any way with some immutable rule (except by proposing to transmute it) are wholly void and without effect. They do not implicitly transmute immutable rules into mutable rules and at the same time amend them. Rule changes that transmute immutable rules into mutable rules will be effective if and only if they explicitly state their transmuting effect.
111. If a rule change as proposed is unclear, ambiguous, paradoxical, or destructive of play, or if it arguably consists of two or more rule changes compounded or is an amendment that makes no difference, or if it is otherwise of questionable value, then the other players may suggest amendments or argue against the proposal before the vote. A reasonable amount of time must be allowed for this debate. The proponent decides the final form in which the proposal is to be voted on and decides the time to end debate and vote. The only cure for a bad proposal is prevention: a negative vote.
112. The state of affairs that constitutes winning may not be changed from achieving n points to any other state of affairs. However, the magnitude of n and the means of earning points may be changed, and rules that establish a winner when play cannot continue may be enacted and (while they are mutable) be amended or repealed.
113. A player always has the option to forfeit the game rather than continue to play or incur a game penalty. No penalty worse than losing, in the judgment of the player to incur it, may be imposed.
114. There must always be at least one mutable rule. The adoption of rule changes must never become completely impermissible.
115. Rule changes that affect rules needed to allow or apply rule changes are as permissible as other rule changes. Even rule changes that amend or repeal their own authority are permissible. No rule change or type of move is impermissible solely on account of the self-reference or self-application of a rule.

116. Whatever is not explicitly prohibited or regulated by a rule is permitted and unregulated, with the sole exception of changing the rules, which is permitted only when a rule or set of rules explicitly or implicitly permits it.

II. *Mutable Rules*

201. Players shall alternate in clockwise order, taking one whole turn apiece. Turns may not be skipped or passed, and parts of turns may not be omitted. All players begin with zero points.
202. One turn consists of two parts, in this order: (1) proposing one rule change and having it voted on, and (2) throwing one die once and adding the number of points on its face to one's score.
203. A rule change is adopted if and only if the vote is unanimous among the eligible voters.
204. If and when rule changes can be adopted without unanimity, the players who vote against winning proposals shall receive 10 points apiece.
205. An adopted rule change takes full effect at the moment of the completion of the vote that adopted it.
206. When a proposed rule change is defeated, the player who proposed it loses 10 points.
207. Each player always has exactly one vote.
208. The winner is the first player to achieve 100 (positive) points.
209. At no time may there be more than 25 mutable rules.
210. Players may not conspire or consult on the making of future rule changes unless they are teammates.
211. If two or more mutable rules conflict with one another, or if two or more immutable rules conflict with one another, then the rule with the lowest ordinal number takes precedence.

If at least one of the rules in conflict explicitly says of itself that it defers to another rule (or type of rule) or takes precedence over another rule (or type of rule), then such provisions shall supersede the numerical method for determining precedence.

If two or more rules claim to take precedence over one another or to defer to one another, then the numerical method must again govern.

212. If players disagree about the legality of a move or the interpretation or application of a rule, then the player preceding the one moving is to be the Judge and to decide the question. Disagreement, for the purposes of this rule, may be created by the insistence of any player. Such a process is called *invoking judgment*.

When judgment has been invoked, the next player may not begin his or her turn without the consent of a majority of the other players.

The Judge's judgment may be overruled only by a unanimous vote of the other players, taken before the next turn is begun. If a Judge's judgment is overruled, the player preceding the Judge in the playing order becomes the new Judge for the question, and so on, except that no player is to be Judge during his or her own turn or during the turn of a teammate.

Unless a Judge is overruled, one Judge settles all questions arising from the game until the next turn is begun, including questions as to his or her own legitimacy and jurisdiction as Judge.

New Judges are not bound by the decisions of old Judges. New Judges may, however, settle only those questions on which the players currently disagree and that affect the completion of the turn in which judgment was invoked. All decisions by Judges shall be in accordance with all the rules then in effect; but when the rules are silent, inconsistent, or unclear on the point at issue, then the Judge's only guides shall be common morality, common logic, and the spirit of the game.

213. If the rules are changed so that further play is impossible, or if the legality of a move is impossible to determine with finality, or if by the Judge's best reasoning, not overruled, a move appears equally legal and illegal, then the first player who is unable to complete a turn is the winner.

This rule takes precedence over every other rule determining the winner.

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Whew! So there you have the rules of Nomic. After reading them, a friend of mine commented, "It won't ever replace Monopoly." I'll grant the truth of that, but it is certainly more interesting than Monopoly to contemplate playing! To make such contemplation even more intriguing, Suber, who has actually played this crazy-sounding game, offers a wide variety of suggestions for interesting types of rule changes. Here are some samples.

Make mutable rules easier to amend than immutable rules, by repealing the unanimity requirement of Initial Rule 203 and substituting (say) a simple majority. Add new tiers above, below, or between the two tiers with which Nomic begins. Make some rules amendable only by special procedures ("incomplete self-entrenchment"). Devise "sunset" rules that automatically expire after a certain number of turns. Allow private consultation between players on future rule changes ("log-rolling"). Allow secret ballots. Allow "constitutional conventions" (or "revolutions") in which all the rules are more easily and jointly subject to change according to new, temporary procedures. Put an upper limit on the number of initially immutable rules that at any given time may be mutable or repealed.

Allow the ordinal numbers of rules to change in certain contingencies, thereby changing their priorities. Or alter the very method of determining precedence; for example, make more recent rules take precedence over earlier rules, rather than vice versa. (In most actual legal systems, the rule of priority favors recent rules.)

Convert the point-earning mechanism from one based on randomness to one based on skill (intellectual or even athletic). Apply a formula to the number on the die so that it will increase the number of points awarded to any player whose proposal gets voted down or whose judgment gets overruled, but will decrease the number of points awarded to a player who votes nay, who proposes a rule change of more than 50 words, who takes more than two minutes to propose a rule change, who proposes to transmute an immutable rule to a mutable rule, or who proposes a rule that is enacted but is later repealed.

Introduce a second or third objective—for example, a cooperative objective, to complement the competitive objective of earning more points. Thus, each player might, on each turn, contribute a letter to a growing sentence, a line to a growing poem, a block to a growing castle, and so on, the group as a whole trying to complete the thing before one of them reaches the winning number of points. Or introduce a second competitive objective, such as having each player make a move in another game, with the winner (or winners) of the game that is finished first obtaining some predetermined advantage in the game that is still being played. Or make some aspect of the game conditional on the outcome of a different game, thus incorporating into Nomic any other game or activity that can muster enough votes. Similarly, leave Nomic pure but add stakes or drama (such as psychodrama).

Institute team play. Require permanent team combinations or allow alliances to shift according to procedures (informal negotiation, an algebraic formula applied to scores, or systematic rotation of partners). Create “hidden” partners (*e.g.*, the points a player earns in a turn are also added to the score of another player, or split with one, selected by a mechanism).

Extend the aptness of the game as a model of the legislative process by inventing an index that goes up and down according to events in the game and that measures “constituency pressure” or “constituency satisfaction”; use the index to constrain permissible moves (*e.g.*, through a system of rewards and penalties). Allow a certain number of turns to pass before a proposal is voted on, giving the players the opportunity to see what other proposals may be adopted in its place.

Suber’s ultimate challenge to players of Nomic is this: to ascertain whether any rules can be made genuinely immutable while preserving some rule-changing power, and whether the power to change the rules can be irrevocably and completely repealed. Suber is interested in hearing from readers about their experiences in playing Nomic, as well as any suggestions for improvement or comments on reflexivity in law generally. His address is: Department of Philosophy, Earlham College, Richmond, Indiana 47374.

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The richness of the Nomic universe is abundantly clear. It certainly meets every hope I had when, in my book *Gödel, Escher, Bach: an Eternal Golden Braid*, I wrote about self-modifying games. It was my purpose there to describe such games in the abstract, never imagining that anyone would work out a game so fully in the concrete. It had been a dream of mine for a long time to devise a system that was in some sense capable of modifying every aspect of itself, so that even if it had what I referred to as “inviolable” levels (corresponding roughly to Suber’s “immutable” rules), they could be modified as well.

I vividly remember how this dream came about. I was a high school student when I first heard about computers from the late George Forsythe, then a professor of mathematics at Stanford (there was no such thing as a department of computer science yet). In his guest lecture to our math class he emphasized two things. One was the notion that the purpose of computing was to do anything that people could figure out how to mechanize. Thus, he pointed out, computing would inexorably make inroads on one new domain after another, as we came to recognize that an activity that had seemed to require ever-fresh insights and mental imagery could be replaced by an ingenious and subtly worked-out collection of rules, the execution of which would then be a form of glorified drudgery carried out at the speed of light. For me, one of Forsythe’s most stunning illustrations of this notion was the way computers had in some sense been applied to themselves—namely in compilers, programs that translate programs from an elegant and human-readable language into the cryptic strings of 0’s and 1’s of machine language.

The other notion Forsythe emphasized—and it was closely related to the first one—was the fact that a program is just an object that sits in a computer’s memory, and as such is no more and no less subject to manipulation by other programs—or even by itself!—than mere numbers are. The fusion of these two notions was what gave me my inspiration to design an abstract computer. Playing on the names of the ENIAC, ILLIAC, JOHNNIAC, and other computers I had heard of, I called it “IACIAC”. I hoped IACIAC could not only manipulate its own programs but also redesign itself, change the way it interpreted its own instructions, and so on. I quickly ran into many conceptual difficulties and never completed the project, but I have never forgotten that fascination. It seems to me that although it is a game and not a computer, Nomic comes closer in spirit to that goal I sought than anything I have ever encountered. That is, except for itself.

Post Scriptum.

As a result of the publication of this column, I received a letter from a law professor named William Popkin, who obviously had found the game of Nomic fascinating while disagreeing philosophically with some points expressed. Subsequently, an exchange between Popkin and me was printed in the “Letters” column in *Scientific American*. Here is what Popkin had to say:

As a law professor I was very interested in Douglas Hofstadter’s piece on reflexivity and self-reference in the law. There are, as he says, many examples. Article V of the United States Constitution prohibits amendments denying

states equal representation in the Senate. The Supreme Court of India went out of its way to create a reflexivity problem by deciding that the normal process of amending the Indian Constitution did not apply to their Bill of Rights, even though no explicit provision prohibiting such amendments existed.

These reflexivity problems are fascinating, but I do not see what they have to do with "general procedures of argument", as Hofstadter (quoting Howard DeLong) suggests. They have everything to do with the meaning of rules, law, and politics, but not with procedures of argument. Let me explain how at least one law professor would approach these problems. Every reflexivity example has the same structure. There is a rule that has specific cases coming under the rule. One particular case, by coming under the rule, appears to undermine the rule itself. For example, assume that the Supreme Court must decide cases properly appealed to it, but that no judge can sit on a case in which he is personally interested. A case arises involving the reduction of judges' salaries, which is arguably unconstitutional. If the judges decide the case, they violate the rule against deciding cases in which they are personally interested, but failure to decide violates the rule requiring them to decide cases. The same structure exists for rules about amendment of the document containing the amending provision. Assume that the Constitution can be amended by a two-thirds vote but that one of the provisions requires a 100 percent vote. An amendment is passed changing the unanimity rule. If the amendment is valid, the unanimity rule is undermined, but if the amendment is invalid, the procedures for amendment are incomplete.

What is presented in all these cases is a problem of meaning and a conflict between rival conclusions, not a logical conundrum. The ultimate decision may be hard or easy, but the issues are not difficult to conceptualize. My own conclusion is that the Supreme Court should hear the case involving its own salary because we do not want Congress deciding such issues, and that the amending power should not extend to the unanimity rule because this breaks the social contract. These are hard cases, but another example presented in Hofstadter's article is easy. It concerns a contract to pay the rhetoric teacher Protagoras when his pupil Euathlus wins his first case. The teacher sues the pupil for the payment, figuring that if he wins the suit he gets his money and if he loses the suit he collects under the contract. But on what possible ground could he win the case before the pupil had won a lawsuit? And how could the original contract, in referring to a victory by the pupil as the occasion for the payment, include a victory in a frivolous lawsuit by the teacher?

What I am pointing out is that reflexivity presents problems of choice, sometimes difficult, sometimes trivial, but that is nothing new in the law. Most important legal problems involve choice without involving reflexivity. Do we prefer a right of privacy or freedom of the press? The deeper point concerns the interaction of law and artificial intelligence and perhaps interdisciplinary studies generally. Reflexivity is undoubtedly an important phenomenon in philosophy for reasons I do not fully appreciate. If developments in artificial intelligence are to be useful in law, however, they must take into account what legal problems are all about. To a lawyer, reflexivity is not a relevant category but choice is. Indeed, I suspect that reflexivity is just a diversion for Hofstadter. In an earlier article about analogy he dealt with the imaginative problem of defining the First Lady of Britain [see Chapter 24]. He there grappled with the

problem of deciding what is like something else, which is the way most lawyers always proceed in making choices. How we make analogies determines how we make choices, and that is the essential nature of all judgment. If that is what artificial intelligence is all about, I very much want to hear more.

As for the question of whether there are immutable rules, the answer is: Of course there are, if that's what you want.

William D. Popkin
Professor of Law
Indiana University.

I found this letter very nicely put, and a constructive opening for a small debate. I replied as follows:

Professor Popkin raises a very interesting point in his comment on my column about Peter Suber's game Nomic. His point is essentially twofold: (1) The fact that any legal system is inevitably chock-full of tangles arising from reflexivity is amusing, but rather than being themselves a deep aspect of law, such tangles are a consequence of other deep aspects, the most significant of which is that (2) the crux of any legal system is the ability of people to distinguish between the incidental qualities and the essential qualities of various events and relations, which ability results finally in recognition of what a given item is—that is, which category the item belongs to. Popkin calls this "choice". In conclusion, he suggests that to discover the principles by which people can "choose" is a critical task for artificial-intelligence workers to tackle.

I feel that neither Suber's *reflexivity* nor Popkin's *choice* is more central than the other in defining the nature of law. In fact, they are intertwined. Suber stresses that people, in choosing which of two inconsistent aspects of a supposedly self-consistent system shall take precedence, often make their choice without explicit rules (since if the rules were spelled out, they would be susceptible to getting embroiled in a similar tangle once again, only at a higher level of abstraction). "Law can disregard logical difficulties and ground a solution on pragmatic rules, social policies, and legal doctrines", Suber has written [in a reply to Popkin]. "The effectiveness of policy, or what Popkin calls 'choice', in plowing under logical obstacles is not the answer to the question but the mystery to be explained."

Coming to grips with this contrast between explicit rules and implicit principles or guidelines is of great importance if one wants to characterize how flexible category recognition—"choice"—takes place, whether one is doing research in artificial intelligence, philosophizing about free will, or attempting to characterize the nature of law. Popkin, in fact, is rather charitable toward artificial-intelligence research, suggesting that it may some day yield clues, if not the key, to the mystery of choice. I think he is right about this. He may have failed to realize, however, that in any attempt to make a machine capable of choice, one runs headlong into the problem of inconsistencies, level-collisions, and reflexivity tangles, and for the following reason.

All recognition programs are invariably modeled on what we know about perception in various modalities, such as hearing and sight. One thing we know

for sure is that in any modality, perception consists of many layers of processing, from the most primitive or "syntactic" levels, to the most abstract or "semantic" levels. The zeroing-in on the semantic category to which a given raw stimulus belongs is carried out not by a purely bottom-up (stimulus-driven) or purely top-down (category-driven) scheme, but rather by a mixture of them, in which hypotheses at various levels trigger the creation of new hypotheses or undermine the existence of already-existing hypotheses at other levels. This process of sprouting and pruning hypotheses is a highly parallel one, in which all the levels compete simultaneously for attention, like billboards or radio commercials or advertisements in the subway.

Yet out of this seemingly anarchic chaos comes an integrated decision, in which the various levels gradually come to some kind of self-reinforcing agreement. If a firm decision is to emerge from such a swirl of conflicting claims, there must be some kind of mental *scheduler*, something that functions like *Robert's Rules of Order*, letting various levels have the floor, scheduling collective actions such as votes, overriding or tabling motions, and so on. In fact, to the best of our knowledge, this is the heart of the perceptual process. But this is the very place where reflexivity tangles crop up with a vengeance!

Any perception program has various levels of "inner sanctum"—that is, levels of untouchability of its data structures. (These structures include not only the current hypotheses, but also deeper, more permanent aspects of the program itself, such as the ways it weights various pieces of evidence, the rules by which it sorts out conflicts, the priority rules of its scheduler, and—of course—the information about the untouchability of levels!) Now, for the ultimate in flexibility, none of these levels should be *totally* untouchable (although that degree of flexibility may be unattainable), but obviously some levels should be less touchable than others. Therefore any recognition program must have at its core a tiered structure precisely like that of government (or that of the rules of Nomic), in which there are levels that are "easily mutable", "moderately mutable", "almost mutable", and so on. The structure of a recognition program—a "choice" program—is seen inevitably to be riddled with reflexivity.

The point of all this is that the very reflexivity issues that Popkin considers to be merely amusing sideshows in law are actually deeply embroiled in what he sees as the meat of the matter, namely the question of how category recognition—discerning the essence of something—works. For that reason, I found Suber's game not merely amusing but philosophically provocative as well. In fact, I consider the intertwined study of reflexivity and recognition, using the fresh methods of the emerging discipline of cognitive science, to be of great interest and importance for the light it may shed on the ancient philosophical problems of mind, free will, and identity—not to mention those of the philosophy of law.

* * *

It occurs to me that the message of my letter to Popkin could be put in a nutshell this way: To get *flexible cognition*, concentrate on *reflexivity* and *recognition*. Some of these ideas will come up again, more specifically in the context of artificial intelligence, in Chapters 23 and 24.

Section II:

Sense and Society

