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Copyright and Information Theory: Toward an Alternative Model of “Authorship”

*Alan L. Durham**

Information theory, born shortly after World War II, has long been a fruitful source of interdisciplinary study, producing insights into communication so apparently universal and so intriguingly counterintuitive that fields as diverse as experimental psychology, particle physics, philosophy, biology, economics, and aesthetics have felt its influence.¹ Among recent advances in mathematics, perhaps only game theory has inspired theoreticians in so many diverse subjects.² One field that so far has not been subjected to information theory analysis is copyright law. Perhaps this demonstrates the pragmatic good sense of copyright scholars—law is not, after all, subject to mathematical proofs. Nevertheless, this Article argues that information theory can contribute useful insights into copyright doctrine, in part by suggesting a more objective and more inclusive alternative to the traditional model of “authorship.”

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1. See Joel E. Cohen, *Translator’s Preface* to ABRAHAM MOLES, *INFORMATION THEORY AND ESTHETIC PERCEPTION* (Joel E. Cohen trans., Univ. of Ill. Press 1966) (1958) (“Standard-bearers of information theory [in the 1950s] were plunging into genetics, neurophysiology, sociology, experimental psychology, linguistics, and philosophy with great enthusiasm and greater hopes.”); L. DAVID RITCHIE, *INFORMATION 7* (Steven H. Chaffer ed., 1991) (“[Information theorist Claude] Shannon’s second essay was widely read by mathematicians, philosophers, psychologists, and others who incorporated its key ideas into disciplines as diverse as electronic engineering, economics, biology, psychology, and the new discipline of cognitive science.”).

2. See, e.g., DOUGLAS G. BAIRD ET AL., *GAME THEORY AND THE LAW* (1994); ROBERT GIBBONS, *GAME THEORY FOR APPLIED ECONOMISTS* (1992); JAMES D. MORROW, *GAME THEORY FOR POLITICAL SCIENTISTS* (1994); ROGER B. MYERSON, *GAME THEORY: ANALYSIS OF CONFLICT* (1991).

The central character in the copyright drama is the “author,” whose distinguishing characteristic is “originality.” Rights to copyrightable works belong, at least initially, to the author³ and extend only as far as the author’s original expression.⁴ In order to be copyrighted, a work must exhibit at least a small measure of originality.⁵ Most works surpass this threshold so easily that little inquiry into what we mean by “author” or “originality” is required. Generally, even the poorest sketch and the most hackneyed novel are unmistakably the products of the mind and abilities of a particular individual. Some works, however, do not so clearly exhibit an “author’s” influence—highly factual works, such as telephone directories, with unremarkable characteristics of selection and organization; works that nearly reproduce existing works by other authors; or works created by mechanical processes with little human intervention. In such cases, the concept of authorship demands closer scrutiny.

The traditional model of authorship is frequently described as the “romantic” model.⁶ The paragon of romantic authorship is an individual who possesses “privileged access to the numinous.”⁷ The romantic author employs his or her gifts in the service of mankind, creating works to entertain and enlighten—works that are unmistakably and uniquely the product of the author’s singular vision. This conception of authorship has by no means disappeared; many authors and artists are still revered for their genius, and new provisions of the Copyright Act protecting artists’ “moral rights,”⁸ particularly in certain works of “recognized stature,”⁹ suggest the continuing vitality of the romantic model.

Recently, however, both literary critics and legal scholars have questioned the romantic notion of authorship as an expression of

3. 17 U.S.C. § 201(a) (2000) (“Copyright in a work protected under this title vests initially in the author or authors of the work.”).

4. *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 348 (1991) (“[C]opyright protection may extend only to those components of a work that are original to the author.”).

5. *See id.* at 345–46.

6. *See, e.g.*, Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965, 1008 (1990).

7. *See* Peter Jaszi, *Toward a Theory of Copyright: The Metamorphoses of “Authorship,”* 1991 DUKE L.J. 455, 459.

8. 17 U.S.C. § 106A (2000) (governing the “moral rights” of attribution and integrity).

9. *Id.* § 106A(a)(3)(B).

individual will. Critics focus on the work, or “text,” at the expense of the author. The “text” is a product of the author’s cultural influences as much as his or her unique persona.¹⁰ In the collaborative endeavor of text consumption, the audience is at least as important as the author;¹¹ consequently, all readings of a text are valid, even if they are not what the author intended.¹² Perhaps Roland Barthes exaggerated when he announced “The Death of the Author,”¹³ but certainly the prevailing analytical perspective leaves the author greatly diminished.

On the copyright front, scholars have similarly questioned whether authorship is correctly envisioned as creation *ex nihilo*. It is often more accurate, they point out, to imagine authors assembling their works from the scraps of their cultural environment, transforming and adapting rather than making anew.¹⁴ Naïve acceptance of authorship as a predominantly individual and creative act may foster authorial rights that are too broad or too powerful for the good of society.

Perhaps literary theorists can choose to ignore the author, but copyright law cannot. The principal object of copyright is to encourage authors, by the grant of exclusive economic rights, to create writings for the ultimate benefit of the public.¹⁵ Authors own those rights, until they are otherwise assigned, and the principle of authorship determines, in significant measure, the dividing line between private ownership and the public domain.¹⁶ Attacks on the

10. See, e.g., ROLAND BARTHES, *The Death of the Author*, in IMAGE-MUSIC-TEXT 142, 146 (Stephen Heath trans., 1977) (“The text is a tissue of quotations drawn from the innumerable centres of culture.”).

11. See Jaszi, *supra* note 7, at 458 n.9 (“[W]hatever form [the text] takes, it is created not in the act of writing but in the act of reading. It ‘asks of the reader a practical collaboration.’” (quoting ROLAND BARTHES, *From Work to Text*, in IMAGE-MUSIC-TEXT 155, 163 (Stephen Heath trans., 1977)); David Nimmer, *Copyright in the Dead Sea Scrolls: Authorship and Originality*, 38 HOUS. L. REV. 1, 167 (2001) (“Literary theory has moved beyond the revelation from on-high of ‘authority (the *auctoritas* of authorship)’ to a realm in which it is the interpretive community that constitutes the text, and the reader reigns supreme.”) (footnotes omitted).

12. See BARTHES, *supra* note 10, at 146.

13. BARTHES, *supra* note 10, at 142.

14. See Litman, *supra* note 6, at 966–67.

15. See *infra* notes 121–25 and accompanying text.

16. See Litman, *supra* note 6, at 1000 (“What we rely on in place of physical borders, to divide the privately-owned from the commons and to draw lines among the various parcels in private ownership, is copyright law’s concept of originality.”).

romantic model of authorship lead us to wonder what “unromantic” model could take its place for purposes of copyright. In other words, how can we conceptualize authorship as a largely transformative act—an elaboration and juxtaposition of existing materials—without losing our sense of what authorship is or how to distinguish between the original and unoriginal, or “authored” and “un-authored,” aspects of a copyrighted work?

It is here that information theory may be useful. As the translator of a work exploring links between information theory and aesthetics warns, in this context “[t]he role of information theory . . . is mainly heuristic: suggestive and exploratory.”¹⁷ Information theory can prove, to the satisfaction of an engineer, the capabilities and limitations of a telemetry system; it cannot prove what Congress intended in the copyright statutes or demonstrate what judicial ruling best promotes creativity. On the other hand, the principles of information theory embrace, at a very fundamental level, all forms of communication. Since works of authorship are, by and large, communicative,¹⁸ it is at least a tantalizing notion that a legal conception of authorship could be constructed upon theoretical foundations laid by information theory.¹⁹

I conclude that such an approach is feasible if authorship is conceived as the unconstrained selection of one means of expression from an array of alternative means—a definition that mirrors information theorists’ approach to quantifying the information encoded in a message. That conception of authorship, already suggested by existing parallels between information theory and copyright’s doctrine of “merger,” answers some of the criticism directed at the traditional “romantic” model—namely, that it

17. Cohen, *supra* note 1.

18. Computer software might be considered an exception, but even a program’s source code is capable of communicating information to another programmer.

19. Caution, though, is certainly in order, given the temptation to draw firm conclusions from loose language. As John R. Pierce said in his valuable survey of the field, [C]ommunication theory . . . deals in a very broad and abstract way with certain important problems of communication and information, but it cannot be applied to all problems which we can phrase using the words *communication* and *information* in their many popular senses. . . . We have no reason to believe that we can unify all the things and concepts for which we use a common word.

JOHN R. PIERCE, AN INTRODUCTION TO INFORMATION THEORY: SYMBOLS, SIGNALS AND NOISE 18 (2d rev. ed., Dover Publ’ns 1980) (1961).

overemphasizes the role of the truth-inspired, meaning-conveying, solitary author/genius.

Part I of this Article explains some of the most basic principles of information theory, including the paradoxical relationship between information and “entropy.” It also discusses differing interpretations of those basic principles and attempts to incorporate meaning into the discussion of information. Part II examines, briefly, the legal concepts of authorship and originality, which have been aptly described as “the very ‘premise of copyright law.’”²⁰ Finally, Part III considers how a more inclusive, “unromantic” model of authorship, in which authorship is primarily an act of selection from an array of alternatives, might be fashioned along lines suggested by information theory.

I. SOME BASIC PRINCIPLES OF INFORMATION THEORY

A. Shannon's Paradox

The founders of information theory include such luminaries as Norbert Wiener, Harry Nyquist, and R.V.L. Hartley,²¹ but the cornerstone of subsequent research is the work of mathematician Claude Shannon. Shannon worked for Bell Laboratories, the research division of AT&T, which perhaps explains his interest in the subject of communication, as well as his interpretation of what he discovered. Shannon's insights were first published in the July and October 1948 issues of the *Bell System Technical Journal* and were eventually republished as *The Mathematical Theory of Communication*, with an explanatory, comparatively speculative essay by Warren Weaver.²² Today, Bell Labs celebrates Shannon's research as one of its greatest achievements, comparable to the invention of the transistor and the laser.²³

20. *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 347 (1991) (quoting *Miller v. Universal Studios, Inc.*, 650 F.2d 1365, 1368 (5th Cir. 1981)).

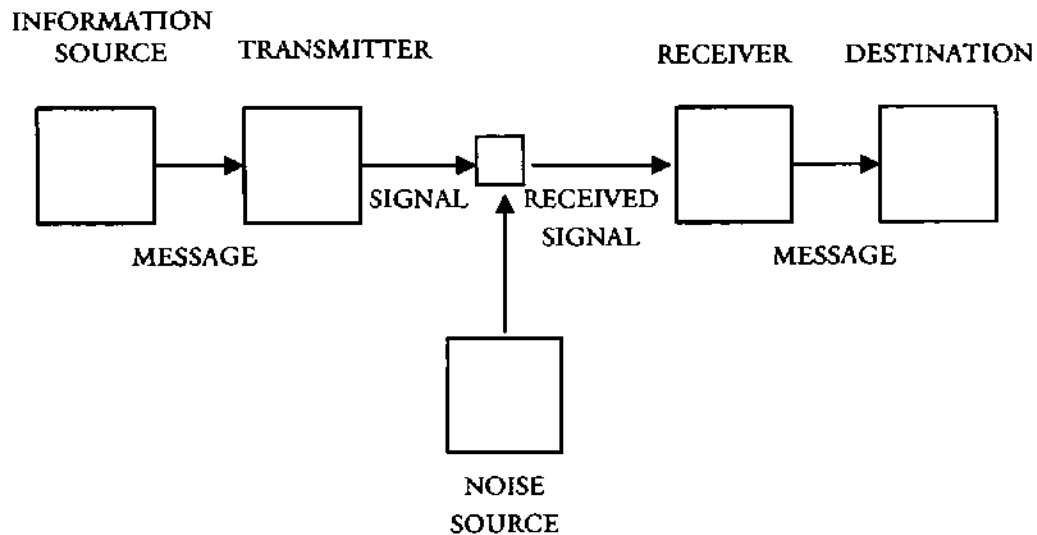
21. See YEHOSHUA BAR-HILLEL, *An Examination of Information Theory, in LANGUAGE AND INFORMATION* 275, 283–85 (Hartley Rogers, Jr. ed., Addison-Wesley Publ'g Co. 1964) (1955) (discussing an early work by Hartley); GUY JUMARIE, *RELATIVE INFORMATION: THEORIES AND APPLICATIONS I* (Hermann Haken ed., 1990).

22. CLAUDE E. SHANNON & WARREN WEAVER, *THE MATHEMATICAL THEORY OF COMMUNICATION* (Univ. Ill. Press 1964).

23. See Lucent Techs., *The Exciting World of Bell Labs*, at <http://www.bell-labs.com/history> (last visited Jan. 21, 2004).

Shannon's ultimate concern was the accurate and efficient communication of messages. Shannon diagrammed the essential elements of a communication system as follows:²⁴

Figure 1



Although the arrows (representing the communication “channel”) connecting the transmitter and receiver are reminiscent of a telephone wire, the diagram applies to any means of communication,²⁵ including speech,²⁶ text, television broadcast, or

24. This diagram is adapted from Shannon's schematic, SHANNON & WEAVER, *supra* note 22, at 34 fig. 1. See also *id.* at 33–35. Some subsequent versions of this diagram substitute the terms “encoder” and “decoder” for “transmitter” and “receiver.” See, e.g., RITCHIE, *supra* note 1, at 12; see also SHANNON & WEAVER, *supra* note 22, at 17 (“[O]ne says, in general, that the function of the transmitter is to *encode*, and that of the receiver to *decode*, the message.”).

25. “Communication” can be defined in various ways. Weaver suggested the “very broad sense” that includes “all of the procedures by which one mind may affect another,” but then observed that even broader definitions are possible, such as “one which would include the procedures by means of which one mechanism (say automatic equipment to track an airplane and to compute its probable future positions) affects another mechanism (say a guided missile chasing this airplane).” SHANNON & WEAVER, *supra* note 22, at 3. While copyright generally presumes a human audience, it is less clear that the “writing” of an “author” must originate in that author's mind as opposed, for example, to some mechanism under the author's control. See *infra* note 246.

26. See SHANNON & WEAVER, *supra* note 22, at 7 (“When I talk to you, my brain is the information source, yours the destination; my vocal system is the transmitter, and your ear and the associated eighth nerve is the receiver.”).

semaphore. There is always a sender, a recipient, and a channel of communication, which can be anything from acoustic vibrations in the air, to electrical impulses, to symbols recorded on paper.²⁷ In some fashion, the information to be transmitted must be reduced to the form suitable for the channel and reconstructed on the receiving end. In the case of a written communication, the message must be encoded by the sender into alphabetical symbols that can be decoded and understood by the reader for whom they are intended.

Multiple layers of encoding may be encountered. A thought might be encoded, in a sense, into language,²⁸ encoded again into written symbols representing that language, and further transformed to match intervening modes of transmission (e.g., binary code representation to electrical impulses or electromagnetic waves), all of which must be reversed for the original thought to be reconstructed. Most, if not all, channels of communication are subject to noise—spurious data that threatens to corrupt the intended message.²⁹ Depending on the medium of transmission, noise could include a mistyped letter, a crackle of static, or the roar of a passing train.

Efficient transmission often calls for messages to be compressed, an economy that can be accomplished in the process of encoding.³⁰ Advertisers in the classified section of the newspaper, who are charged by the letter to transmit their messages, often practice the art of compression, writing, for example, “a/c” instead of “air conditioning” or “41k” instead of “41,000 miles on the odometer.” Such compression is possible because the English language as written has significant *redundancy*, meaning that it employs more symbols than are necessary to allow the message to be reconstructed.³¹

27. See *id.* at 25 (“This is a theory so general that one does not need to say what kinds of symbols are being considered—whether written letters or words, or musical notes, or spoken words, or symphonic music, or pictures.”).

28. See PIERCE, *supra* note 19, at 118 (discussing “meaningful language as a sort of code of communication”).

29. See SHANNON & WEAVER, *supra* note 22, at 7 (referring to “noise” as “certain things . . . added to the signal which were not intended by the information source”).

30. See *id.* at 75. Shannon discusses how “proper encoding” can take advantage of statistical knowledge of the information source to reduce the required channel capacity. An example is the use of the shortest Morse Code symbol, the dot, to stand for the most common letter in the English language, *e. Id.*

31. See PIERCE, *supra* note 19, at 143; RITCHIE, *supra* note 1, at 33. This can be illustrated by reproducing only the consonants in a passage of text: ftn th txt cn still b ndrstd.

Compression by efficient coding is beneficial—fewer letters to print, faster transmission times, lower bit rates—but the price comes in greater vulnerability to noise. The redundancy of standard English allows errors to be recognized and corrected more easily than would be the case if the language were more “efficient.” A typist who strikes the *x* key when *c* was intended might produce “air xonditioning,” but chances are the message would still be correctly understood; “a/x,” on the other hand, if more efficient in terms of the requirements of transmission, is less likely to be understood.³²

As far as communications engineers are concerned, Shannon’s most significant work may be his insight into the theoretical limits of error correction in relation to channel capacity. That, however, is not what has fired the imagination of so many researchers in other fields. What is exciting to them, because it seems at the same time fundamental and bizarre, is the way Shannon equates information with *disorder*.

Shannon approached signal transmission as a *stochastic* process,³³ from the Greek word meaning “to guess.”³⁴ This means that the choice of each symbol in a message is governed by a set of probabilities, which can be dependent (in the special case of a *Markoff process*) on the occurrence of preceding symbols.³⁵ As

Shannon formally defines “redundancy” as “one minus the relative entropy,” the latter referring to the “ratio of the entropy of the source [see *infra* notes 45–48 and accompanying text] to the maximum value it could have while restricted to the same symbols.” SHANNON & WEAVER, *supra* note 22, at 13. Redundancy accounts for the attributes of a message determined “by the accepted statistical rules governing the use of the symbols in question.” *Id.* Shannon estimated that the redundancy of common English is, at scales of structure encompassing eight or fewer letters, about fifty percent. *Id.* As Weaver noted,

It is sensibly called redundancy, for this fraction of the message is in fact redundant in something close to the ordinary sense; that is to say, this fraction of the message is unnecessary (and hence repetitive or redundant) in the sense that if it were missing the message would still be essentially complete, or at least could be completed.

Id.

32. Where correctness is particularly critical, redundancy may be added by repetition (“Now hear this! Now hear this!”) or by other methods (“That’s *R* as in Richard, *E* as in Elephant, *D* as in David . . .”).

33. See SHANNON & WEAVER, *supra* note 22, at 11.

34. See JEREMY CAMPBELL, *GRAMMATICAL MAN: INFORMATION, ENTROPY, LANGUAGE AND LIFE* 28 (1982).

35. See SHANNON & WEAVER, *supra* note 22, at 11 (“A system which produces a sequence of symbols (which may, of course, be letters or musical notes, say, rather than words) according to certain probabilities is called a *stochastic process*, and the special case of a stochastic

elements of a message are received, one by one, the recipient might guess, based on those probabilities, what the next symbol is likely to be. If the message symbols previously received were “i n f o r m a t i o” the odds are high that the next symbol will be “n.” On a smaller scale, u is far more likely to follow q than any other letter in a correctly transmitted message.³⁶ Shannon found that the quantity of information in a message, in terms of the demands of transmission, is related to the distribution of probabilities among the possible components of that message.

To take the simplest example, suppose that a message could consist only of two symbols—one or zero, on or off, black or white. Shannon used p and q ,³⁷ so to adapt his symbology let us imagine that a sales clerk signals to a stockroom when a customer orders one of the two available flavors of pie: “p” for peach or “q” for quince. The transmission for a period of sales might look something like “p p p p q p p p q p p p p.” If nearly every customer ordered peach, one could find ways to compress the stream of messages; for example, “q q q q” might signify not the unheard-of event of four consecutive orders of quince, but instead the routine event of 100 consecutive orders of peach. On the other hand, if one noticed that ten consecutive orders of one flavor were nearly always followed by ten of the other, one could economize on the messages, taking advantage of the characteristics of the Markoff process. One could not compress the message, however, if orders of peach or quince were equally likely and no predictions could be made based on prior events.³⁸

process in which the probabilities depend on the previous events, is called a *Markoff process* or a *Markoff chain*.”).

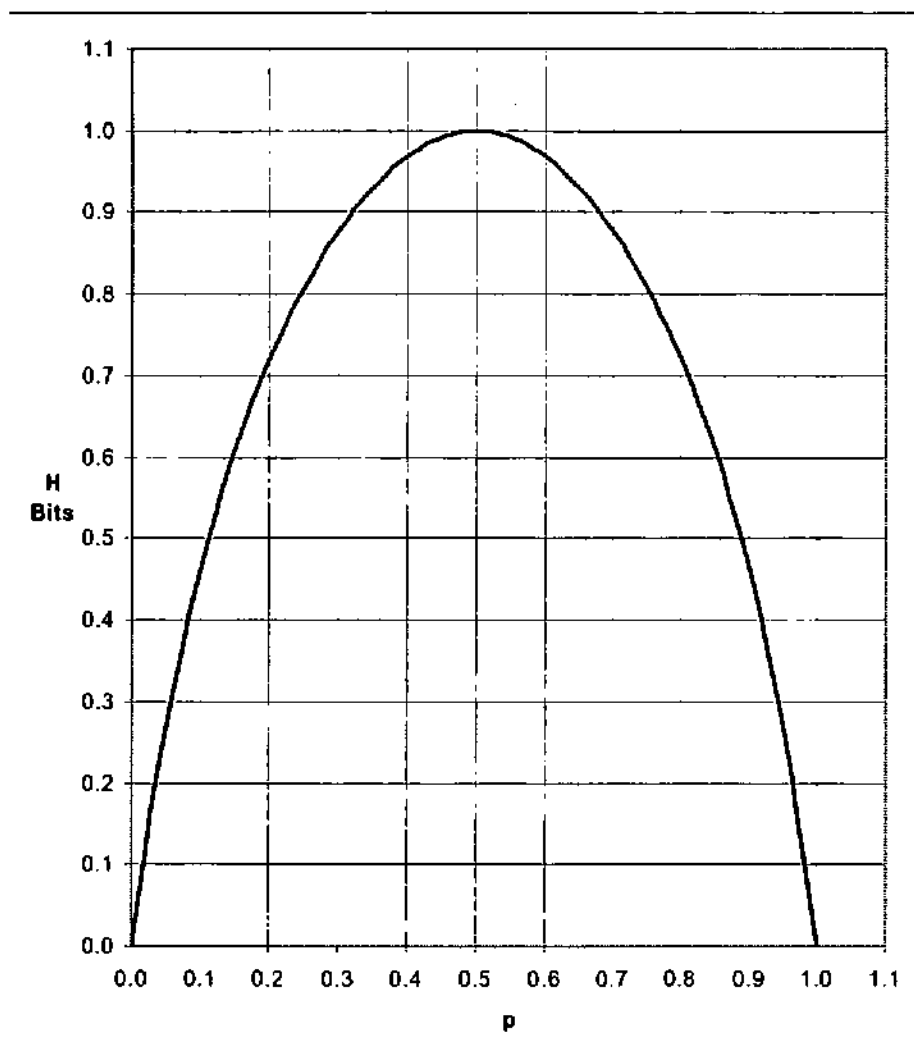
36. See PIERCE, *supra* note 19, at 49.

37. Strictly speaking, Shannon used p and q to represent the *probability* that either alternative would occur. Hence, the two alternatives could be x and y , with p representing the probability of x and q representing the probability of y . However, it seems less confusing to think of p (probability p) and q (probability q) as the two alternatives.

38. The message could not be compressed because it would already carry the maximum possible information per symbol. If the code required *three* symbols for *each* pie order (“p p p” for peach or “q q q” for quince), the information “density” of the messages would be reduced by that redundancy. The messages would be less vulnerable to error, since a mistake could more often be identified for what it was, but the messages would also be more predictable, more redundant, and more demanding of time or other resources.

Shannon produced the following graph,³⁹ showing on the horizontal axis the probability of the occurrence of p rather than q , and on the vertical axis the quantity of information, expressed as H , in a message communicating the event.

Figure 2



If the message is *certain* to be p rather than q , so that probability p is 100%, then the information content of the message is zero. By

39. Reproduced from SHANNON & WEAVER, *supra* note 22, at 50 fig. 7. The equation for H (the quantitative measure of information in bits) is $H = -(p \log p + q \log q)$, where p and q are the probability of the two possible occurrences.

the same token, if the message is certain *not* to be p (so that it is certain to be the only other possibility, q) the information content of the message is also zero.⁴⁰ This much seems intuitively obvious: a message that could only have one outcome is not a message worth sending. As the outcome becomes uncertain, the information content of the message rises, reaching its peak (one “bit” of information per symbol) where p and q are equally probable.⁴¹ If the odds are biased in favor of p or q , the information content per symbol is something less than one bit; the stream of symbols might, with the right encoding, be compressed.⁴²

Although this example posits only two possible messages, the quantity of information can be raised by increasing the number of possible messages. Like evening out the probabilities between messages, increasing the number of potential messages increases the uncertainty and, hence, increases H .⁴³ To put it concretely, “[a] message which is one out of ten possible messages conveys a smaller amount of information than a message which is one out of a million possible messages.”⁴⁴

Shannon courted controversy by referring to H , the measure of information present in the message, as “entropy”—a term borrowed from the physical sciences.⁴⁵ To a physicist, entropy refers to the randomness, disorder, or *shuffled-ness* that arises as ordered physical systems break down or unwind.⁴⁶ According to the second law of thermodynamics, any closed physical system tends inevitably toward

40. See SHANNON & WEAVER, *supra* note 22, at 51 (“[O]nly when we are certain of the outcome does H vanish.”).

41. See *id.* (“This is also intuitively the most uncertain situation.”).

42. Although information is maximized when all possible code elements are equally likely, that does not mean that the code elements in any *particular* message will be evenly distributed. “ H is always calculated for the distribution of elements in a *typical* message. It only means that, in a sufficiently large random sample of messages drawn from the code set, the distribution will tend toward equal probability.” RITCHIE, *supra* note 1, at 33.

43. See *id.* at 5.

44. PIERCE, *supra* note 19, at 23.

45. See N. KATHERINE HAYLES, CHAOS BOUND: ORDERLY DISORDER IN CONTEMPORARY LITERATURE AND SCIENCE 49 (1990) (“Rumor has it that von Neumann told Shannon to use the word because ‘no one knows what entropy is, so in a debate you will always have the advantage.’”).

46. See SHANNON & WEAVER, *supra* note 22, at 12 (“[T]he tendency of physical systems to become less and less organized, to become more and more perfectly shuffled, is so basic that Eddington argues that it is primarily this tendency which gives time its arrow . . .”).

entropy, as does the universe as a whole.⁴⁷ Mathematically, Shannon's H looks just like entropy.⁴⁸

To equate information with entropy, suggesting that the most disordered message is the most information-laden message,⁴⁹ is a puzzling concept at first.⁵⁰ It would seem that structure is required to make a message "informative" in any conventional sense; a completely disordered message could only be gibberish. Furthermore, Shannon's measure of information implies that when noise interferes with a message, disrupting its order in unpredictable ways,⁵¹ this actually *adds information* to the message rather than, as we would imagine, subtracting information.⁵² Suppose that, in our hypothetical, customers ordered peach rather than quince ninety-nine percent of the time, producing, in any particular instance, a highly predictable message ("peach again"). If a short circuit randomly flipped the intended p or q to its opposite, the odds of receiving a q would rise, evening out the probabilities somewhat and

47. See STEPHEN HAWKING, A BRIEF HISTORY OF TIME 102, 144–45 (1990); 18 MCGRAW-HILL ENCYCLOPEDIA OF SCIENCE & TECHNOLOGY 339–40 (8th ed. 1997).

48. See SHANNON & WEAVER, *supra* note 22, at 12–14. Pierce, however, warns against equating the entropy of information theory with the entropy of physics:

Once we understand entropy as it is used in communication theory thoroughly, there is no harm in trying to relate it to the entropy of physics, but the literature indicates that some workers have never recovered from the confusion engendered by an early admixture of ideas concerning the entropies of physics and communication theory.

PIERCE, *supra* note 19, at 80.

49. Ritchie notes,

In general, *entropy* refers to the degree of randomness or dispersion among elements of some set Organization and structure constrain the order in which elements may appear and hence make some elements more probable in certain positions. For example, English spelling requires that each word have at least one vowel. Consequently, H can also be considered a measure of disorganization: The more organized a system, the lower the value of H .

RITCHIE, *supra* note 1, at 5.

50. Even Weaver, one of Shannon's greatest champions, admits that Shannon's theories seem, at first, "disappointing and bizarre." SHANNON & WEAVER, *supra* note 22, at 27. The disappointment stems from the unwillingness to deal with meaning, as discussed *infra* note 56 and accompanying text.

51. See RITCHIE, *supra* note 1, at 53–54 ("[N]oise,' in signal transmission theory, refers to any random alteration in the signal. Thus, in a statistical sense, the more noise there is in a channel, the more likely it is that elements in any string will have been randomly altered . . .").

52. See SHANNON & WEAVER, *supra* note 22, at 19 ("[I]f the uncertainty is increased [by the addition of noise], the information is increased, and this sounds as though the noise were beneficial!").

causing the information content of the message to increase.⁵³ If noise completely obscured the intended message, making it impossible for anyone to tell whether the next symbol would be p or q, information would be maximized—odd as that might seem to the customers who kept receiving the wrong flavor of pie.

This paradoxical result⁵⁴ led some to equate information with order, or *negative* entropy.⁵⁵ Shannon's willingness to link information with *disorder* can be explained by his exclusion of *meaning* from the equation.⁵⁶ When AT&T is considering how to transmit messages accurately and efficiently, it is unlikely to concern itself with what those messages signify. A message that is jumbled nonsense is no easier to transmit; in fact, Shannon's reasoning demonstrates that it is *more* difficult, or more demanding, to transmit accurately. The unpredictability of a randomized message means that compression is less feasible and that more resources are necessary to guard against error.

In the context of transmission and retransmission, noise certainly adds *something* to the message. If a highly ordered message is transmitted from A to B (e.g., "p p q q p p q q p p q q p p q q . . ."), A could devise an efficient code to compact the message.

53. See RITCHIE, *supra* note 1, at 54 ("Noise is likely to increase the statistical variety of the signal by equalizing the distribution of probabilities, because the more frequently used elements are more likely to be affected by random processes . . ."); SHANNON & WEAVER, *supra* note 22, at 51–52 ("Any change toward equalization of the probabilities . . . increases *H*").

54. Ritchie maintains that increasing information by increasing noise is a "false paradox," and he accuses Weaver of a "mistake" in equating *H* with "subjective uncertainty." RITCHIE, *supra* note 1, at 53–54. *H*, according to Ritchie, has nothing to do with a recipient's knowledge of the contents of a message, but is only "a statistical description of the distribution of elements in a set." *Id.* Ritchie distinguishes between *H* and "information," which requires a human context. *Id.* at 65–67. The debate is, at least in part, over proper terminology.

55. See COLIN CHERRY, ON HUMAN COMMUNICATION 216 (2d ed. 1966).

56. "The word *information*, in this theory, is used in a special sense that must not be confused with its ordinary usage. In particular, *information* must not be confused with meaning." SHANNON & WEAVER, *supra* note 22, at 8; see also RITCHIE, *supra* note 1, at 5; SHANNON & WEAVER, *supra* note 22, at 31 ("The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently messages have *meaning*, that is, they refer to or are correlated to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem."). Jumarie holds that theories dealing only with the transmission of symbols should be called "communication theory," whereas "information theory" "should deal with both symbols and their meanings." JUMARIE, *supra* note 21, at 2. Most works, however, still refer to Shannon's insights as a part of "information theory."

If the message were sent in uncompacted form to *B*, and on the way encountered noise that randomly changed many of the symbols, the resulting jumble (e.g., “p p p q p p q p q p p q q q p q p p q”) would be far more difficult for *B* to compress. If the goal were for *B* to understand the message transmitted by *A*, the change would be undesirable—the message would be less “informative.”⁵⁷ But from an engineer’s perspective, taking into account the requirements of channel capacity and encoding, the message would have gained “information,” as *B* would appreciate when attempting to retransmit the message he *received*, noise and all, to *C*.

B. Information and Meaning

As Shannon noted in his first essay, messages generally do have meaning: “[T]hey refer to or are correlated to some system with certain physical or conceptual entities.”⁵⁸ For example, a message says “Mary called while you were away” because an entity known as “Mary” performed the action known as “calling” while the condition of the message recipient was “away.” Shannon avoided semantic issues because they were irrelevant to the engineering considerations. If the message had said “Ypio cfsvwq while you were vzykg,” it would have been as demanding, if not more demanding, to transmit.⁵⁹ However, Shannon’s insights suggested the discovery of a new aspect of nature—“information”—as basic, perhaps, as energy or time. Inevitably, other theorists began to consider how meaning might be incorporated into Shannon’s framework.

Referring to the strange conjunction of information and entropy that Shannon had revealed, Warren Weaver expressed “the vague feeling that information and meaning may prove to be something like a pair of canonically conjugate variables in quantum theory, they being subject to some joint restriction that condemns a person to the

57. Weaver distinguishes between “desirable” and “undesirable” information: “It is thus clear where the joker is in saying that the received signal has more information. Some of this information is spurious and undesirable and has been introduced via the noise. To get the useful information in the received signal we must subtract out this spurious portion.” SHANNON & WEAVER, *supra* note 22, at 19.

58. *Id.* at 31.

59. *See id.* at 8 (“[T]wo messages, one of which is heavily loaded with meaning and the other of which is pure nonsense, can be exactly equivalent, from the present viewpoint, as regards information.”).

sacrifice of the one as he insists on having much of the other.”⁶⁰ In other words, if a message included unpredictable twists, the entropy of the message—and, consequently, its “information”—would increase, but its intelligibility would suffer, and with it the capacity of the message to convey meaning.

Shannon’s example of *Finnegans Wake*⁶¹ suggests the trade-off. When Joyce is in his stride, his prose resembles a random concatenation of syllables, such as in this example: “The howsayto itishwatis hemust whomust worden schall. A darktongues, kunning. O theoperil! Ethinop lore, the poor lie. He askit of the hoothed fireshield but it was untergone into the matthued heaven.”⁶² One would find it difficult, based on familiar patterns or probabilities, to condense that message. Compared to common English prose, it is high in information and low in redundancy. It is also, for most people, virtually meaningless.

On the other hand, *too much* pattern or predictability can also impair the capacity of a message to convey meaning. A message that endlessly repeats itself, for example, strikes the listener as dull precisely because once the pattern is established the message has nothing to say. As common sense suggests, the most *effective* communication for conveying meaning is that which mixes order and surprise. The familiar, predictable patterns orient the audience and distinguish the message from noise;⁶³ the unexpected variations

60. *Id.* at 28.

61. Shannon notes,

Two extremes of redundancy in English prose are represented by Basic English and by James Joyce’s book *Finnegans Wake*. The Basic English vocabulary is limited to 850 words and the redundancy is very high. This is reflected in the expansion that occurs when a passage is translated into Basic English. Joyce on the other hand enlarges the vocabulary and is alleged to achieve a compression of semantic content.

Id. at 56; see also CAMPBELL, *supra* note 34, at 71 (“James Joyce extended his freedom by throwing overboard some of the rules of language in an exuberant search for novelty. In *Finnegans Wake*, he allowed himself a much wider variety of possible messages than, say, Jane Austen, who observed the rules more scrupulously.”).

62. This example is borrowed from CAMPBELL, *supra* note 34, at 71 (quoting JAMES JOYCE, *FINNEGANS WAKE* 223 (Penguin Books 1999) (1939)). Indeed, Campbell himself, or the preparers of the edition of *FINNEGANS WAKE* on which he relied, may have made some mistakes in reproducing this brief passage. Cf. JOYCE, *supra*, at 223 (showing “itiswhatis” instead of “itishwatis” and “Ethiaop” instead of “Ethinop”). Such mistakes are telling illustrations of the link between information and entropy, as well as the vulnerability to noise of messages with low redundancy. See CAMPBELL, *supra*, at 71–72.

63. See *id.* at 68–69 (“A written message is never completely unpredictable. If it were, it would be nonsense. Indeed, it would be noise. To be understandable, to convey meaning, it

give the message a purpose.⁶⁴ In any event, the relationship between meaning and information, as defined by Shannon, must be more complex than a simple antithesis.

Attempts to incorporate meaning, or *semantics*, into information theory rely on the idea that generating messages is a process of *selection from a group of possible messages*.⁶⁵ If the symbol set consists of p and q, and each message consists of a string of four symbols, the message "q q p q" is one of sixteen possible messages. *H*, the measure of "information," is maximized if each of those sixteen messages is equally probable, as would be the case if the message were randomly selected. *H* is minimized if the message is somehow restricted to "q q p q" and nothing else.⁶⁶ At this point, it should be emphasized that *H* is not so much a characteristic of a particular message as it is a characteristic of the probabilities governing all messages that a source might generate.⁶⁷ As Weaver expresses it, "this word information in communication theory relates not so much to what you *do* say, as to what you *could* say."⁶⁸ If you (the message source) *could* say anything because the alternatives are equally probable, what you *do* say carries maximum information. If what you *could* say is restricted because the probabilities are skewed, what you *do* say, in the long run, carries less information.

H can be approached in different ways, depending on whether one views it from the perspective of the message source, the message

must conform to rules of spelling, structure, and sense, and these rules, known in advance as information shared between the writer and the reader, reduce uncertainty.").

64. See *id.* at 28 ("[T]he whole point of a message, the whole point of writing the next sentence in a book, is that it should contain something new, something unexpected. Otherwise there would be no reason to write it in the first place.").

65. See SHANNON & WEAVER, *supra* note 22, at 7 ("The *information source* selects a desired *message* out of a set of possible messages The selected message may consist of written or spoken words, or of pictures, music, etc.").

66. See *id.* at 15 ("In the limiting case where one probability is unity (certainty) and all others zero (impossibility), then *H* is zero (no uncertainty at all—no freedom of choice—no information).").

67. See RITCHIE, *supra* note 1, at 31 ("[T]he value of *H* for each datum must be calculated on the basis of the distribution of elements in the code, not on the basis of the distribution of data in any particular message."); SHANNON & WEAVER, *supra* note 22, at 9 ("Note that it is misleading (although often convenient) to say that one or the other message conveys unit information [i.e., one bit, when there are two equally probable messages]. The concept of information applies not to the individual messages (as the concept of meaning would), but rather to the situation as a whole").

68. SHANNON & WEAVER, *supra* note 22, at 8.

recipient, or the engineer responsible for operating the channel. One's perspective seems to bear on the problem of incorporating semantics into the broader framework of information. Shannon adopts the more aloof engineer's perspective, which can ignore what a message means. The only concern is the requirements of transmission, which may be just as demanding for a meaningless message. H , from this perspective, is a function of probability distributions and the demands they place on coding and channel capacity.⁶⁹

Weaver, on the other hand, often characterizes H as a measure of *freedom of choice*, which suggests the perspective of the message source. Thus, Weaver observes that " H is largest when the . . . probabilities are equal (i.e., when one is completely free and unbiased in the choice), and reduces to zero when one's freedom of choice is gone."⁷⁰ He notes that more "choices" lead to increased information: "There is more 'information' if you select freely out of a set of fifty standard messages, than if you select freely out of a set of twenty-five."⁷¹ H is maximized when all potential messages are equally probable so that "one is completely free and unbiased in the choice" and zero when the absolute certainty of one message means that "one's freedom of choice is gone."⁷² Finally, Weaver refers to "redundancy" as "the fraction of the structure of the message which is determined not by the free choice of the sender, but rather by the accepted statistical rules governing the use of the symbols in question."⁷³ Weaver's characterization of H as a measure of "choice" seems to interject a human presence, in comparison to Shannon's more technically oriented perspective. It also seems consistent with

69. Ritchie treats H as solely a measure of "the information capacity of the code" reflecting "the dispersion of elements in the code from which the message elements were assembled." RITCHIE, *supra* note 1, at 54. Thus, "the observer's *subjective* uncertainty about what message was sent" may be affected by noise in the channel, but the noise has no effect on H . *Id.*

70. SHANNON & WEAVER, *supra* note 22, at 15; *see also* PIERCE, *supra* note 19, at 105 ("[I]n connection with the message source we think of the entropy as a measure of choice, the amount of choice the source exercises in selecting the one particular message that is actually transmitted.").

71. SHANNON & WEAVER, *supra* note 22, at 16.

72. *Id.* at 5.

73. *Id.* at 13.

Weaver's inclination to distinguish between "desirable" and "undesirable" information.⁷⁴

From the perspective of the message *recipient*, H may best be characterized as a measure of uncertainty.⁷⁵ If a particular message is virtually inevitable (e.g., the pie order is almost always peach), the message carries, in both the practical and the formal sense, little information. The recipient, over the course of repeated messages, seldom learns anything that the recipient did not already suspect ("peach again").⁷⁶ If the probabilities are more nearly equal, increasing the value of H , or if a broader variety of messages could be received, then the recipient experiences increased uncertainty prior to receiving the message.⁷⁷ The uncertainty is maximized when the content of the message is completely random and therefore completely unpredictable—which also represents the maximum of information in Shannon's terms.⁷⁸ It is the same principle as before but from a different point of view. As Weaver summarizes, "greater freedom of choice, greater uncertainty, greater information go hand in hand."⁷⁹

Once again, the uncertainty represented by H is a characteristic of "the situation as a whole"⁸⁰—i.e., the set of all possible messages and their relative probabilities—rather than a characteristic of any

74. See *supra* note 57.

75. See PIERCE, *supra* note 19, at 23.

76. See *id.* at 80 ("If the message source involved no choice, if, for instance, it could produce only an endless string of ones or an endless string of zeros, the recipient would not need to receive or examine the message to know what it was; he could predict it in advance. Thus, if we are to measure information in a rational way, we must have a measure that increases with the amount of choice of the source and, thus, with the uncertainty of the recipient as to what message the source may produce and transmit.").

77. See *id.* at 23 ("The amount of information conveyed by the message increases as the amount of uncertainty as to what message actually will be produced becomes greater The entropy of communication theory is a measure of this uncertainty and the uncertainty, or entropy, is taken as the measure of the amount of information conveyed by a message from a source.").

78. See CAMPBELL, *supra* note 34, at 63.

79. SHANNON & WEAVER, *supra* note 22, at 18–19; see also PIERCE, *supra* note 19, at 81 ("[Entropy] increases as the freedom of choice (or the uncertainty to the recipient) increases and decreases as the freedom of choice and the uncertainty are restricted. For instance, a restriction that certain messages must be sent either very frequently or very infrequently decreases choice at the source and uncertainty for the recipient, and thus such a restriction must decrease entropy.").

80. SHANNON & WEAVER, *supra* note 22, at 9.

particular message.⁸¹ Some who adopt the recipient's point of view refer to the "surprisal" value of a message as a measure of the information carried by *that message*.⁸² "Surprisal" is a function of how far a particular message deviates from the expectations of the recipient. If the probabilities are biased toward a particular message ("peach again"), the "surprisal" value of that message is low, but on the rare occasions when the alternative message is received ("quince this time!"), the "surprisal" value is high. In fact, it is higher than it could be where all probabilities are equal. However, the rarity of the surprising message in the skewed-probability situation means that, in the long run, the equal-probability situation generates more information.⁸³

From the recipient's perspective, resolving uncertainty is, in John R. Pierce's phrase, "the aim and outcome of communication."⁸⁴ The message source chooses which of all possible messages to transmit, and delivery removes the recipient's uncertainty as to which message might have been received.⁸⁵ The resolution of uncertainty is a function not only of the message received but also of what the recipient already knows: "the more we know about what message the source will produce, the less uncertainty, the less the entropy, and the less the information."⁸⁶ It is generally presumed that the recipient at least has prior knowledge of the code.⁸⁷ A message in

81. Ritchie insists that "probabilities always refer to the general case, prior to any observation, and cannot be calculated for a particular message that has already been observed." RITCHIE, *supra* note 1, at 31.

82. See FRED I. DRETSKE, KNOWLEDGE AND THE FLOW OF INFORMATION 10, 12 (CSLI Publ'ns 1999) (1981).

83. See *id.* at 12 ("Although, generally speaking, the greatest *average information* is obtained when the possibilities are equally likely, the greatest *surprisal values* are to be obtained when the possibilities are not equally likely.").

84. PIERCE, *supra* note 19, at 79.

85. See *id.* at 105 ("We think of the recipient of the message, prior to the receipt of the message, as being uncertain as to which among the many possible messages the message source will actually generate and transmit to him. Thus, we think of the entropy of the message source as measuring the uncertainty of the recipient as to which message will be received, an uncertainty which is resolved on receipt of the message.").

86. *Id.* at 23.

87. See RITCHIE, *supra* note 1, at 44 ("The selection of medium and code presupposes an extensive prior exchange of information (during the design process), and the communicative event cannot be fully understood without considering this preparatory information. In effect, the advance exchange of information establishes the external structure of the code, its relationship to the signal transmission system and to the meanings to be communicated.").

Chinese would be highly unpredictable and, in the sense of uncertainty, full of “information” to a recipient who had never encountered the language. Every character would come as a complete surprise. After receiving many messages in Chinese, the recipient might begin to perceive the patterns that produce the redundancy in any language⁸⁸—certain characters, for example, would be more likely to appear together than certain other characters. Eventually missing elements might be filled in with reasonable confidence, even though, without some Rosetta-stone equivalent, the recipient would never know what the messages *meant*.

Even from Shannon’s engineering point of view, the recipient’s prior knowledge is important in determining the requirements of the communication channel. The term “a/c” can be more efficiently substituted for “air conditioning” only if the intended recipient has already learned the code, perhaps through some other channel. A sufficiently elaborate code can permit highly efficient messages. The symbol “1” could stand for the complete text of the King James Bible.⁸⁹ Of course, one would pay the price for such efficiency by having to deliver, one way or another, a very substantial code book.

The best prospect for incorporating meaning into information theory is to adopt the recipient’s perspective, treating H as a measure of the recipient’s uncertainty. Some information theorists, such as Guy Jumarie, define information as the difference in the recipient’s uncertainty before and after receiving the message.⁹⁰ That difference depends upon the observer.⁹¹ Someone who did not speak Chinese would have his uncertainty reduced only in a very superficial fashion by receiving a copy of a Chinese newspaper—he could be certain of the symbols in the document, but he would be no more enlightened

88. See *supra* text accompanying notes 31–32.

89. See SHANNON & WEAVER, *supra* note 22, at 9.

90. See JUMARIE, *supra* note 21, at 46. Jumarie considers entropy a measure of uncertainty and information a difference in entropy. *Id.* at 23.

91. See *id.* at 62 (“Basically, all information should be regarded as information relative to a given observer, and the latter should appear as a parameter in the definition of this information. One way to achieve this is to introduce semantics in the modelling of information since this semantics is not constant but depends upon the observer who receives the informational content of the message.”). The observer’s perspective can also change over time. An observer who had no reason to doubt the fairness of a die would initially assume that the chance of rolling a particular number was one out of six. If a series of trials revealed that the die was loaded, the observer’s expectations would change. See *id.* at 6–7.

about the events described. On the other hand, a reader fluent in Chinese would resolve her uncertainty about the world beyond the symbols—assuming the document were trustworthy—because for her the message would have meaning.⁹² Moreover, her prior knowledge of the events described in the newspaper would enhance her comprehension of its contents.⁹³ For Jumarie, “information” is more of a relative and subjective concept, and it is incomplete unless the idea of meaning is included. In fact, Jumarie, unlike Shannon, introduces the concept of “negative information” to describe a communication that leaves the recipient subjectively more uncertain than before.⁹⁴

If “information” is defined from the point of view of a message’s capacity to resolve uncertainty, the influence of noise becomes less paradoxical. Noise may increase the statistical variety of the messages it affects, but, as L. David Ritchie argues, “It is never the case that information increases as an observer becomes more uncertain about what signal was actually transmitted, and it is certainly never true, as Weaver claimed, that random perturbations in a signal . . . can somehow increase the information content of the signal.”⁹⁵ This point of view assumes that the only uncertainty the observer cares to resolve is uncertainty about the message dispatched by the message source—in other words, what did the source actually say? If the observer, however, is uncertain about and interested in what *the noise itself* may produce, treating the noise as though it were a message source, then the noise would increase the information content of the signal from this observer’s point of view. This may seem a fine point, but it will have some bearing on the discussion of alternative models

92. *See id.* at 66.

93. *See id.* at 7, 81 (discussing the example of a knowledgeable reporter who would understand that a telegram referring to the “long stride of the civil servants” was intended to read “long *strike* of the civil servants”). Campbell also uses the common examples of Japanese as the unfamiliar language and economics combined with Japanese as the unfamiliar semantic context. *See* CAMPBELL, *supra* note 34, at 63. If the message source is an economics lecture in English, the message will be indistinguishable from noise to a Japanese speaker. To an English speaker unfamiliar with economics, knowledge of the language will make the message better understood, and in some respects more predictable. An English speaker familiar with economics will understand the message best and will be surprised the least. *Id.*

94. *See* JUMARIE, *supra* note 21, at 23–24. Jumarie concludes that negative information must be postulated before information theory can be applied in areas like “biology, linguistics, [and] human sciences.” *Id.*

95. RITCHIE, *supra* note 1, at 55.

of authorship, which may be broad enough to embrace the production of disordered or “noisy” texts.⁹⁶

D.M. MacKay, not long after the publication of Shannon’s essays, attempted to integrate meaning into information theory by adopting the subjective viewpoint of the message recipient.⁹⁷ MacKay defined the meaning of a message as the capacity of the message to select among the possible internal states of the recipient.⁹⁸ If you “catch my meaning,” my message has accomplished the desired alteration of your internal state. MacKay referred to those internal states as the “conditional-probability matrix or ‘C.P.M.’” of the receiver⁹⁹—a rarified term that seems to refer more appropriately to the speech of computers than to that of human beings. It could refer, for example, to the recipient’s awareness of a visitor.¹⁰⁰ A message referring to the visitor selects the corresponding state of the recipient’s awareness, if the recipient is not already aware of the facts.¹⁰¹ The potential of the message to select that state is the “meaning” of the message.¹⁰² A message is “meaningless” if it cannot perform the selective function, either because its terms are undefined or because its terms are internally inconsistent.¹⁰³

96. See *infra* note 248 and accompanying text.

97. D.M. MacKay, *The Place of ‘Meaning’ in the Theory of Information, in INFORMATION THEORY: PAPERS READ AT A SYMPOSIUM ON ‘INFORMATION THEORY’ HELD AT THE ROYAL INSTITUTION, LONDON, SEPTEMBER 12TH TO 16TH 1955*, at 215 (Colin Cherry ed.) (1956).

98. See *id.* at 219.

99. *Id.* at 218–19.

100. See *id.* at 218 (“Let us now picture a communication process in which you send a message (*M*) to me. For example, *M* might be ‘Someone is waiting for you outside’. Now we may assume that by sending *M* to me you intend to produce some effect on me. . . . What kind of effect is this? Obviously it need not be an immediate change in my observable pattern of behavior. What you are concerned with is my ‘total state of readiness’: in objective terms, the set or matrix of conditional probabilities of different possible patterns of behavior in relevant circumstances. For example, you want me when I leave the room to behave as if I expected to find someone outside, and so forth.”).

101. See *id.*

102. *Id.* at 219. MacKay is more technical and more rigorous than this paraphrase may suggest. He defines the “meaning” of a message as “its selective function on a specified ensemble” and holds that “[t]he selective information content of the message measures logarithmically the size of the change brought about by its selective operation on the same ensemble.” *Id.* at 223.

103. See *id.* at 219 (“Correspondingly, we find two kinds of meaningless sentence. ‘The gups are plee’ is meaningless to most of us for the first reason. ‘The water is isosccles’ is

Meaning, according to this point of view, is not an absolute—it can be judged only in relation to a particular message recipient.¹⁰⁴ What is meaningless to one recipient may be meaningful to another,¹⁰⁵ and how a recipient perceives the meaning of a message depends upon the recipient's internal state (or potential internal states).¹⁰⁶ MacKay, and later Jumarie, suggests that observers maintain some form of internal representation corresponding to the observer's understanding of the world,¹⁰⁷ which can be altered by the selective power of a meaningful message. If I believe that no visitors are waiting for me, or if I have no information one way or the other, a message that a visitor *is* waiting for me selects a new set of expectations.¹⁰⁸ Note that selection is a recurring theme in information theory: "information" relates to the freedom of an

meaningless for the second. On the other hand, 'This stochastic process is stationary' is probably meaningless to most of our fellow mortals for the first reason; and 'The radiation from a horn-fed cheese' (actual title from a paper on Microwaves!) perhaps equally meaningless for the second.").

104. See JUMARIE, *supra* note 21, at 78 ("[W]e may consider as a basic axiom the statement that the meaning of a message is only a meaning relative to a given observer."). Bar-Hillel, on the other hand, argues that "*the concept of semantic information has intrinsically nothing to do with communication*. If an explication for this concept can be found, then the proposition that all apples are red will carry a certain amount of information entirely independently of whether a statement to this effect is ever transmitted." BAR-HILLEL, *supra* note 21, at 287.

105. See MacKay, *supra* note 97, at 219.

106. See JUMARIE, *supra* note 21, at 63 ("A given set of symbols . . . may have different significances to different observers depending upon the respective interests, that is to say the respective internal states of these observers. If we discard this feature in modelling information, we are missing an important property of human observers, and so we cannot expect to suitably describe information processes involving human factors.").

107. See *id.* ("[I]n the general case, the observer mainly relies on a pre-existing internal model that he has about the observable under consideration, i.e., a set of expectations."); MacKay, *supra* note 97, at 221–22 ("[T]he range of ensembles to which a meaningful object or event has a selective relationship by virtue of its meaning is restricted to those of representational states. In the human organism, for example, we may presume that there are certain internal states of the information-flow-system which constitute implicitly representations of the subjects' world of activity, both conceptual and physical.").

108. This concept leaves room for inaccurate information, which would shift one's expectations incorrectly, or even for fiction, where one knows that one is creating a counterfactual model of reality. The important thing is that a meaningful message leads to further inferences and internal representations. See MacKay, *supra* note 97, at 221. If one learns that a character in a novel has been murdered, one's expectations for additional fictional events is altered. The statement that the character has been murdered is, therefore, a meaningful statement.

information source to select among possible messages,¹⁰⁹ and “meaning,” according to MacKay, relates to the capacity of a message to select among possible internal states of the recipient.

We have already seen that the information communicated by a message source can be limited by the redundancy built into the code.¹¹⁰ If U inevitably follows Q , the messages employing that code are more predictable—hence, they have lower entropy and, in terms of H , less information. According to some information theorists, patterns imposed by meaning also limit information. For example, in the pie-ordering hypothetical, there is nothing in the code that demands more p’s than q’s. It is the preference of the pie-ordering public that causes “p” to predominate, thereby limiting the information content of the messages.¹¹¹ Jumarie refers to two entropies, one relating to symbols and the other relating to meaning, that in conjunction determine the overall entropy of the message source.¹¹²

II. ORIGINALITY AND EXPRESSION

Although it does not concern itself with information or meaning, copyright law grapples with equally abstract and elusive concepts, such as “originality,” “creativity,” and “idea” versus “expression.” Part II of this article discusses the role of these concepts in defining what can or cannot be claimed as property, setting the stage for a potential union between copyright’s concept of authorship/originality and Shannon’s concept of “information.”

109. See *supra* notes 70–72 and accompanying text.

110. See *supra* notes 98–103 and accompanying text.

111. Dretske offers biased coin flips and weather forecasts during monsoon season as examples of circumstances giving rise to diminished information. DRETSKE, *supra* note 82, at 9.

112. See JUMARIE, *supra* note 21, at 101 (“[W]e shall characterize an informational variable by means of two entropies: an entropy associated with the symbol of this variable, i.e. the usual entropy, and a conditional entropy which describes its semantics.”). Jumarie refers to the two entropies as “syntactic entropy” and “semantic entropy.” *Id.* at 102. See also John Mingers, *The Nature of Information and its Relationship to Meaning*, in PHILOSOPHICAL ASPECTS OF INFORMATION SYSTEMS 73, 75 (R.L. Winder et al. eds., Taylor & Francis 1997) (1993) (“The information content of a message now depends on both the *syntactic* structure of the symbols and the *semantic* structure of the observer. The syntactic information depends on the number of possible symbols (e.g., words) and their probabilities of occurrence as usual. But now, each word may have a number of different meanings and each will have a conditional probability dependent on the particular observer. There is thus an additional uncertainty term in the Shannon formulae.”).

Part II.A explores the goals of copyright, which include the dissemination of knowledge for the public benefit. Part II.B discusses the fundamental copyright “dichotomies” that define the realm of copyrightable subject matter. Part II.C highlights existing similarities in the area of “merger” between copyright doctrine and the principles of information theory discussed in Part I.

A. Copyright Goals

The Constitutional basis for copyright protection lies in Article I, Section 8, Clause 8, which empowers Congress to “promote the Progress of Science . . . by securing for limited Times to Authors . . . the exclusive Right to their . . . Writings.”¹¹³ “Science,” according to historians, referred to all forms of knowledge or learning, not merely those that would be called “science” today.¹¹⁴ “Writings” has never been confined to its narrowest sense. The earliest copyright statutes included maps and charts as copyrightable subject matter,¹¹⁵ and other forms of expression, such as music, photographs, and choreography, have gradually been added to the list.¹¹⁶ Until the term expires, the owner of a copyright possesses the exclusive right to reproduce, adapt, distribute, perform, or display the copyrighted work.¹¹⁷ The term of copyright, which has lengthened with new legislation, is currently the life of the author plus seventy years.¹¹⁸ Initially, copyright is awarded to the author of the work,¹¹⁹ though the author may assign his rights to others.¹²⁰

113. U.S. CONST. art. 1, § 8, cl. 8. Parallel language in the same clause, referring to the “Discoveries” of “Inventors” and the progress of the “Useful Arts,” forms the constitutional basis for patent law. See Alan L. Durham, *“Useful Arts” in the Information Age*, 1999 BYU L. REV. 1419, 1424–26.

114. See Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 51 (1949); Arthur H. Seidel, *The Constitution and a Standard of Patentability*, 48 J. PAT. OFF. SOC’Y 5, 11–12 (1966).

115. See *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 56–57 (1884).

116. See 17 U.S.C. § 102(a) (2000) (listing categories of copyrightable material).

117. See *id.* § 106. Those rights are limited by principles such as fair use, see *id.* § 107, and first sale, see *id.* § 109.

118. *Id.* § 302(a)–(c). Copyright in “anonymous works, pseudonymous works and works made for hire” expires 95 years after publication or 120 years after creation, whichever comes first. *Id.* § 302(c).

119. *Id.* § 201(a).

120. *Id.* § 201(d).

The reason for granting exclusive rights to copyrighted works is that expressed in the Constitution: they are granted in order to promote the “progress of science,” or, in other words, to stimulate the growth of the nation’s intellectual life. The period of exclusive rights permits the authors of valuable works to reap their rewards in the marketplace.¹²¹ Since works of authorship are typically more expensive to create than to reproduce, the labor and inspiration of authors might not be recouped if copyright did not assure authors, at least for a limited period of time, an exclusive market for their works. Without exclusive rights, authors would have less incentive to create, and the consuming public, as a result, would enjoy fewer works of expression or works of lesser quality.

As courts have assured us on many occasions, copyright exists for the benefit of the public.¹²² Copyright is not, primarily, a means for defending the natural rights of authors. The interests of authors and the interests of the public generally coincide; however, because copyright is a property right, there is always potential conflict between those who own and those who are excluded. Moreover, it is in the nature of expression, and the development of culture in any form, that the new builds upon the old.¹²³ In literature, music, or the visual arts, we can trace influences or substantial borrowings forward or backward in time. Few artists are not part of a “tradition,” and few authors—particularly authors who produce works based on fact—rely entirely on their own materials. Advancements in intellectual matters would be greatly hindered if every borrowed idea or scrap of data had to be compensated or reinvented.¹²⁴ Consequently, ensuring the “progress” of knowledge and culture requires consideration not only of the rights and rewards of today’s author but also of the freedom of tomorrow’s author to continue the process.¹²⁵

121. See *Harper & Row Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 546 (1985) (“The rights conferred by copyright are designed to assure contributors to the store of knowledge a fair return for their labors.”).

122. See, e.g., *id.* (“The monopoly created by copyright . . . rewards the individual author in order to benefit the public.” (quoting *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 477 (1984) (Blackmun, J., dissenting))).

123. See *Nash v. CBS, Inc.*, 899 F.2d 1537, 1540 (7th Cir. 1990) (“Intellectual (and artistic) progress is possible only if each author builds on the work of others. No one invents even a tiny fraction of the ideas that make up our cultural heritage.”).

124. See *id.* at 1540–41.

125. As Judge Easterbrook observed,

If copyright law is to benefit the public as intended, it must balance the opposing tugs of author incentive and consumer access. An example of that trade off is the “fair use” exception to copyright infringement, which permits the reproduction of small portions of copyrighted works in such contexts as education, news reporting, and critical analysis.¹²⁶ For our purposes, the most important instance of compromise is embodied in the concepts of “expression” and “originality.”

B. Copyright Dichotomies

One of the fundamental principles of copyright law is that an idea cannot be copyrighted;¹²⁷ only an author’s *original expression* of an idea can be copyrighted. The most famous discussion of the “idea/expression dichotomy” is contained in Judge Learned Hand’s opinion in *Nichols v. Universal Pictures Corp.*,¹²⁸ where the plaintiff, author of a play entitled *Abie’s Irish Rose*, accused the defendant’s motion picture, *The Cohens and the Kellys*, of copyright infringement. The works were similar in their outlines—both involved a romance between a Catholic and a Jew and the animosity between their respective families—but the stories differed in significant details. Judge Hand framed the distinction between idea and expression in terms of specificity. In a frequently quoted passage, he observed that

[u]pon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at

At each instant some new works are in progress, and every author is simultaneously a creator in part and a borrower in part. In these roles, the same person has different objectives. Yet only one rule can be in force. This single rule must achieve as much as possible of these inconsistent demands.

Id. at 1541.

126. See 17 U.S.C. § 107 (2000). Parody is another example of creative expression that depends on the use (generally unauthorized use) of existing works. See *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 580–81 (1994) (“[T]he heart of any parodist’s claim to quote from existing material . . . is the use of some elements of a prior author’s composition to create a new one that, at least in part, comments on that author’s works. . . . Parody needs to mimic an original to make its point, and so has some claim to use the creation of its victim’s (or collective victims’) imagination . . .”).

127. 17 U.S.C. § 102(b) (“In no case does copyright protection for an original work of authorship extend to any idea . . .”).

128. 45 F.2d 119 (2d Cir. 1930).

times might consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his "ideas," to which, apart from their expression, his property is never extended.¹²⁹

The "ideas" of the plaintiff's work—the broader aspects of the story, included in the more general descriptions or higher "levels of abstraction"—could not be copyrighted, even if those ideas were original. Although the author "discovered the vein, she could not keep it to herself."¹³⁰ She could copyright only the particular manner in which those ideas were expressed. That is not to say that only word-for-word plagiarists are guilty of appropriating expression.¹³¹ Expression might include, in a literary work, such things as settings, character traits, and plot twists. In *Nichols*, Judge Hand determined that the similarities were too general to be characterized as anything other than similarities of idea.¹³²

The "levels of abstraction" analysis is not so much a test of copyrightability as a starting point.¹³³ Judge Hand did not venture to say where expression fades into idea "as more and more of the incident is left out."¹³⁴ Referring to that "essential question," Judge Easterbrook observed that "[a]fter 200 years of wrestling with copyright questions, it is unlikely that courts will come up with the answer anytime soon, if indeed there is 'an' answer, which we doubt."¹³⁵ The difficulty is not a philosophical one, although terms like "idea" and "expression" have an epistemological dimension; for purposes of copyright, the distinction is largely a matter of policy.¹³⁶ In other words, bearing in mind the objective of intellectual progress and the need to balance access and incentive, a court determines what aspects of the copyrighted work should be reserved as the

129. *Id.* at 121.

130. *Id.* at 122.

131. *Id.* at 121 (noting that copyright "cannot be limited literally to the text, else a plagiarist would escape by immaterial variations").

132. *Id.* at 121–22.

133. See *Nash v. CBS, Inc.*, 899 F.2d 1537, 1540 (7th Cir. 1990).

134. *Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir. 1930); see *Peter Pan Fabrics, Inc. v. Martin Weiner Corp.*, 274 F.2d 487, 489 (2d Cir. 1960) (Hand, J.) ("Obviously, no principle can be stated as to when an imitator has gone beyond copying the 'idea,' and has borrowed its 'expression.'").

135. *Nash*, 899 F.2d at 1540.

136. See Jane C. Ginsburg, *No "Sweat"? Copyright and Other Protection of Works of Information After Feist v. Rural Telephone*, 92 COLUM. L. REV. 338, 346 (1992).

author's exclusive property and what aspects should be consigned to the public domain—the former it dubs “expression” and the latter “idea.”¹³⁷ The analysis is more instinctual than otherwise, and the results inevitably “ad hoc.”¹³⁸

A parallel dichotomy contrasts “fact” and “expression.” In *Feist Publications, Inc. v. Rural Telephone Service Co.*,¹³⁹ the Supreme Court considered whether a telephone company could use copyright law to prevent a rival from duplicating its white-pages telephone listings. In an opinion marked by strong rhetoric, the Court recalled “[t]he most fundamental axiom of copyright law”¹⁴⁰ that “[n]o author may copyright his ideas or the facts he narrates.”¹⁴¹ Facts cannot be copyrighted because they are not “original”; that is, “facts do not owe their origin to an act of authorship.”¹⁴² Facts are discovered, not created.¹⁴³ The Court called originality the “the *sine qua non* of copyright”¹⁴⁴ and held that the Constitution itself, by its reference to “authors” and “writings,” mandates originality in copyrightable works.¹⁴⁵ As far as copyright law is concerned, “facts are free for the taking.”¹⁴⁶

This does not mean that factual works such as histories or news reports can be copied at will. If the author of the work “clothes [the] facts with an original collocation of words”¹⁴⁷—that is, if the author expresses the facts in her own fashion, as historians or journalists inevitably do—subsequent authors must confine their borrowing to the facts themselves. They must avoid using the first author’s “expression,” which does “owe [its] origin” to the creative faculties

137. See *Herbert Rosenthal Jewelry Corp. v. Kalpakian*, 446 F.2d 738, 742 (9th Cir. 1971) (“At least in close cases, one may suspect, the classification the court selects may simply state the result reached rather than the reason for it.”).

138. *Peter Pan Fabrics*, 274 F.2d at 489.

139. 499 U.S. 340 (1991).

140. *Id.* at 344.

141. *Id.* at 345 (quoting *Harper & Row Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 556 (1985)).

142. *Id.* at 347.

143. *Id.* (“The distinction is one between creation and discovery: The first person to find and record a particular fact has not created that fact; he or she has merely discovered its existence.”).

144. *Id.* at 348.

145. *Id.* at 346.

146. *Id.* at 349 (quoting Jane C. Ginsburg, *Creation and Commercial Value: Copyright Protection of Works of Information*, 90 COLUM. L. REV. 1865, 1868 (1990)).

147. *Id.* at 348.

of the author. Like the idea/expression dichotomy, the fact/expression dichotomy can be easier to state than to apply.¹⁴⁸ When the work is a bare compilation of facts, like a telephone directory, there is little room for expression and hence little that can be protected by copyright.¹⁴⁹ Then the “only conceivable expression,” and the only aspect of the work eligible for copyright protection, “is the manner in which the compiler has selected and arranged the facts.”¹⁵⁰

Even though selection and arrangement can provide the necessary element of originality,¹⁵¹ the *Feist* Court held that plaintiff Rural’s telephone directory fell short. Here the Court introduced the notion of “creativity” as an aspect of originality:

[O]riginality is not a stringent standard; it does not require that facts be presented in an innovative or surprising way. It is equally true, however, that the selection and arrangement of facts cannot be so mechanical or routine as to require no creativity whatsoever. The standard of originality is low, but it does exist.¹⁵²

Rural’s directory was “entirely typical” and “garden-variety.”¹⁵³ The “selection” of information “could not be more obvious.”¹⁵⁴ Rural published only what one would expect in any telephone directory—the names of subscribers, arranged alphabetically, and their telephone numbers. Although preparing the directory required “‘selection’ of a sort,” Rural’s actions “lack[ed] the modicum of creativity necessary to transform mere selection into copyrightable expression.”¹⁵⁵

148. One of the difficulties lies in the problematic distinction between fact and opinion. See Alan L. Durham, *Speaking of the World: Fact, Opinion, and the Originality Standard of Copyright*, 33 ARIZ. ST. L.J. 791, 838–40 (2001).

149. See *Feist*, 499 U.S. at 349 (“Where the compilation author adds no written expression but rather lets the facts speak for themselves, the expressive element is more elusive.”).

150. *Id.*; see also 17 U.S.C. § 103(b) (2000) (“The copyright in a compilation . . . extends only to the material contributed by the author of such work, as distinguished from the preexisting material employed in the work, and does not imply any exclusive right in the preexisting material.”).

151. See 17 U.S.C. § 101 (2000) (defining “compilation”).

152. *Feist*, 499 U.S. at 362.

153. *Id.*

154. *Id.*

155. *Id.*

Similarly, Rural could not prevail on the claim that its “coordination” or “arrangement” of the facts was sufficiently original to sustain a claim of copyright:

The white pages do nothing more than list Rural’s subscribers in alphabetical order. This arrangement may, technically speaking, owe its origin to Rural; no one disputes that Rural undertook the task of alphabetizing the names itself. But there is nothing remotely creative about arranging names alphabetically in a white pages [telephone] directory. It is an age-old practice, firmly rooted in tradition and so commonplace that it has come to be expected as a matter of course. It is not only unoriginal, it is practically inevitable. This time-honored tradition does not possess the minimal creative spark required by the Copyright Act and the Constitution.¹⁵⁶

Even where expression includes the requisite “spark” of creativity, there are occasions where idea and expression or fact and expression cannot be disentangled. In those cases, the expression “merges” with the idea or the fact, rendering even the expression ineligible for copyright protection. Merger occurs when there are so few ways to express a simple fact or idea that exclusive rights to particular manners of expression would soon exhaust the possibilities. Such exhaustion would have a practical effect similar to copyrighting the fact or idea itself.

In *Herbert Rosenthal Jewelry Corp. v. Kalpakian*,¹⁵⁷ the plaintiff’s copyrighted work was a jeweled pin in the form of a bee. The defendant’s work was similar, though not identical.¹⁵⁸ Even if the defendant had copied from the plaintiff’s work, a fact that was far from evident, the court held that the “idea” of a jeweled bee pin could be freely copied.¹⁵⁹ The plaintiff itself conceded that only its “expression” of that idea could be protected.¹⁶⁰ The Ninth Circuit found, however, that the idea and its expression were “indistinguishable.”¹⁶¹ The similarities between the two pins were “inevitable from the use of jewel-encrusted bee forms in both,”¹⁶² a

156. *Id.* at 363 (internal citation omitted).

157. 446 F.2d 738 (9th Cir. 1971).

158. *See id.* at 741.

159. *Id.* at 742.

160. *Id.*

161. *Id.*

162. *Id.*

conclusion reinforced by the inability of the plaintiff's counsel to suggest any manner in which a jeweled bee pin could be fashioned without infringing the plaintiff's copyright.¹⁶³ "When the 'idea' and its 'expression' are thus inseparable," the court held, "copying the 'expression' will not be barred, since protecting the 'expression' in such circumstances would confer a monopoly of the 'idea' upon the copyright owner"¹⁶⁴

In *Morrissey v. Proctor & Gamble Co.*,¹⁶⁵ the First Circuit Court of Appeals upheld summary judgment for the defendant, whom the plaintiff accused of infringing its copyright on the written rules of a simple sweepstakes contest. The two versions of the rules were, indeed, very similar—so much so that copying would be difficult to dispute.¹⁶⁶ Nevertheless, the court denied the claim because the substance or "idea" of the contest could be monopolized by appropriating the very few ways of expressing the rules:¹⁶⁷ "We cannot recognize copyright as a game of chess in which the public can be checkmated."¹⁶⁸

Whether idea and expression merge depends upon how the idea is defined. The more general the idea, the more ways there are in which the idea can be expressed. If the idea of the pin in *Herbert Rosenthal* were described simply as "a jeweled pin in the shape of an animal," the possibilities for expression would be boundless. Pins in the shape of snails, zebras, whales, or hummingbirds could all be characterized as expressions of that idea, and the defendant could hardly complain that the similarities in two bee-shaped pins were inevitable. Conversely, if the idea were described, hypothetically, as "a one-inch pin in the shape of a common honey bee, fashioned from contrasting bands of gold and silver, including a one-carat diamond on each 'wing' and three one-half-carat diamonds arranged

163. *Id.* at 740.

164. *Id.* at 742.

165. 379 F.2d 675 (1st Cir. 1967).

166. *See id.* at 678.

167. The court noted,

When the uncopyrightable subject matter is very narrow, so that "the topic necessarily requires" if not only one form of expression, at best only a limited number, to permit copyrighting would mean that a party or parties, by copyrighting a mere handful of forms, could exhaust all possibilities of future use of the substance.

Id. (citation omitted).

168. *Id.* at 679.

longitudinally on the bee's 'thorax,'" the room for variation, and hence expression, would be comparatively limited. Any pin that met that description might look the same to a jury. Thus, the higher one proceeds up the "levels of abstraction" scale, and the more "incident" one leaves out in defining the idea of the work, the less danger there is of merger. In *Herbert Rosenthal*, the court settled on the middle ground of "jeweled bee pin," which is what the plaintiff seemed to claim as its exclusive preserve.¹⁶⁹

Merger of fact and expression may also occur if there is only a small number of ways in which a fact can be expressed. Here merger is conceptually simpler because levels of generality are irrelevant. One would not distinguish, for example, between a "high-level" fact (e.g., "sequoias are large trees") and a detailed, "low-level" fact (e.g., "the 'General Sherman' sequoia is 274.9 feet tall and its trunk is 102.6 feet in circumference at the base"). Even a very specific fact is, in the *Feist* sense, "unoriginal" and in the public domain. Note that merger is contextual: *if* one makes a jeweled bee pin, there are a limited number of ways to do it; *if* one adopts the rules of a particular sweepstakes contest, there are a limited number of ways to explain them. For policy reasons, copyright doctrine does not force new authors to seek new contexts—new facts or new ideas—for their own expression. It is more important that those facts and ideas be available to the public from multiple sources.

C. Comparisons to Information Theory

Where there is little room for expression, we could also say there is little room for "information," or a situation low in "entropy." Weaver characterized information as a measure of what one "*could* say"¹⁷⁰—the fewer distinctive messages one can send, the lower the value of H .¹⁷¹ Similarly, the narrower the range of "messages" from which an author can choose to communicate a particular idea, the closer one comes to merger. One can speak, in both instances, in terms of freedom: as H "reduces to zero when [the message sender's] freedom of choice is gone,"¹⁷² so an author's bid to produce protectable expression "reduces to zero" when there is only

169. *Herbert Rosenthal*, 446 F.2d at 742.

170. SHANNON & WEAVER, *supra* note 22, at 8.

171. See PIERCE, *supra* note 19, at 23.

172. SHANNON & WEAVER, *supra* note 22, at 15.

one way to express an idea and the author's "freedom of choice is gone."

H , as previously discussed,¹⁷³ is a product not only of the number of messages one could transmit but also of the distribution of probabilities among those possible messages. H increases as the probabilities even out,¹⁷⁴ and it is maximized when the message source is "as little as possible driven toward some certain choices which have more than their share of probability."¹⁷⁵ A counterpart in copyright doctrine is what *Feist* refers to as "creativity." The information in a telephone directory could be arranged in countless ways—most of them completely useless. It is far more probable, for reasons of custom and utility, that a directory will be arranged in the conventional alphabetical-by-last-name fashion than in any other manner. *Feist* described that arrangement as "entirely typical"¹⁷⁶ and indeed "practically inevitable"¹⁷⁷—language indicative of an arrangement having much more than its "fair share of probability." The arrangement is "so commonplace that it has come to be expected as a matter of course"¹⁷⁸—exactly what one might say of the information-impoverished peach pie orders discussed in the earlier hypothetical.¹⁷⁹

Information is reduced when messages are transmitted in a comparatively "redundant" code.¹⁸⁰ Compared to the telegraphic style of classified advertisements, a message composed in standard English prose communicates a less concentrated form of information. Many of the choices—such as which letter follows which letter, or which word follows which word—are dictated more by the conventions of the language than by the free choice of the message sender. Information is reduced because "entropy" is reduced. Syntactic conventions also limit the author's expression. If the ideas to be communicated are simple and the occasion calls for straightforward, conventional language, it is more difficult for an author to find room for variation. Theoretically, this is within the

173. See *supra* notes 43–48 and accompanying text.

174. See *supra* text accompanying note 43.

175. SHANNON & WEAVER, *supra* note 22, at 15.

176. *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 362 (1991).

177. *Id.* at 363.

178. *Id.*

179. See *supra* text accompanying note 76.

180. See *supra* note 31 and accompanying text.

control of the author; the rules of a sweepstakes contest could be communicated with a Joyce-like freedom of language ("O purchaseproof! O sending selfaddressed!"), or the compilers of a telephone directory could decree that Baker will precede Able. Generally, however, custom and practicality limit the available means of expression, dictating a more redundant, less flexible code.

Information is further limited by patterns in the data. A message sender reporting the results of biased coin tosses (producing "heads" more often than "tails" or vice versa) transmits less information than one who reports the results of an honest coin toss.¹⁸¹ Here information and authorship diverge, at least if information is regarded from the perspective of the recipient. If information is a function of the recipient's pre-message uncertainty, a report consisting of unknown and unpredictable facts would be rich in information, even if the report's "originality," in the *Feist* sense of author contribution, were low. The concept of "conditional entropy," discussed more fully in the next section,¹⁸² might provide a better parallel to originality in factual works. One form of conditional entropy describes the variability added to a message when it is transmitted through a noisy channel—something comparable, perhaps, to what happens when an author communicates a fact.

One should not make too much of these similarities. Legal constructs like originality cannot be reduced to mathematical abstractions, nor is it likely that creativity will ever be expressed in bits. On the other hand, the principles of information theory necessarily apply to the kinds of works that authors create and that copyright protects, whether they consist of written symbols, musical notes, pictorial representations, or other means of expression.¹⁸³ Information theory is "deep enough so that the relationships it reveals indiscriminately apply to all these and to other forms of communication."¹⁸⁴ It is tempting, therefore, to imagine a more explicit union between information theory and the legal concept of authorship, which takes as its starting point the existing parallels between Shannon's theories and standard copyright doctrine.

181. See DRETSKE, *supra* note 82, at 11-12.

182. See *infra* text accompanying note 237.

183. See SHANNON & WEAVER, *supra* note 22, at 25.

184. *Id.*

In the next section, I will consider what a new model of authorship inspired by information theory might look like and how it could serve as an “unromantic” alternative to the traditional “romantic” model.

III. “ROMANTIC” AND “UNROMANTIC” AUTHORSHIP

A. *The “Romantic Model”*

The romantic model of authorship regards an author’s creative powers as self-generated, mysterious, and “magical.”¹⁸⁵ The author’s creative powers are so profoundly personal, so intimately associated with the deepest recesses of the author’s personality, that the works they inspire are inevitably unique. They reveal “the hand of the master.” As Jessica Litman explains,

The expression is unique because the real author is using words, musical notes, shapes, or colors to clothe impulses that come from within her singular inner being. This mysterious inner being may be the repository of impressions, experiences, and the works of other authors, but the author’s individual sensibility recasts that raw material into something distinct and unrecognizable.¹⁸⁶

According to historian Martha Woodmansee, the predominant notion of an author as a self-inspired genius is of relatively recent origin.¹⁸⁷ Until the romantic movement of the eighteenth century, authors, including artists and composers, were more commonly viewed as skilled craftsmen in their more earth-bound moments or as divine instruments when their efforts surpassed the ordinary.¹⁸⁸ A new emphasis on individualism,¹⁸⁹ perhaps fueled by the increasing freedom of authors to support themselves by means other than

185. Litman, *supra* note 6, at 1008.

186. *Id.* (citations omitted); see also Martha Woodmansee, *The Genius and the Copyright: The Economic and Legal Conditions of the Emergence of the “Author,”* 17 EIGHTEENTH-CENTURY STUD. 425, 429 (1984).

187. Woodmansee, *supra* note 186, at 426.

188. *Id.* at 427 (“It is noteworthy that in neither of these conceptions is the writer regarded as distinctly and personally responsible for his creation.”).

189. See Jaszi, *supra* note 7, at 455 (“During the eighteenth century, ‘authorship’ became intimately associated with the Romantic movement in literature and art, expressing ‘an extreme assertion of the self and the value of individual experience . . . together with the sense of the infinite and the transcendental.’” (alteration in original) (quoting THE OXFORD COMPANION TO ENGLISH LITERATURE 842 (M. Drabble ed., 5th ed. 1985))).

patronage,¹⁹⁰ gave birth to the more “romantic” conception.¹⁹¹ No longer a “vehicle of preordained truths—truths as ordained either by universal human agreement or by some higher agency—the *writer* became an *author* (Lat. *auctor*, originator, founder, creator).¹⁹² Of course, such rhetoric is best applied to the greatest writers, artists, and composers; few authors stand out from their peers, much less scale the pinnacle of genius. The romantic model defines authorship chiefly in terms of the ideal.

The romantic model of authorship can be restated in the language of information theory. The mind of the author is the *message source*. The work is the message, and its purpose is to convey the sender’s intentions to the awaiting audience. The author’s interpretation of the message is preemptive, “because it is the author’s genius, the author’s special knowledge, which created this [message] *ex nihilo*.”¹⁹³ The audience is no more interested in forming an individualized interpretation of the message than a person calling information would be interested in an individualized interpretation of a telephone number. The audience only wants to resolve its uncertainty as to the author’s meaning. If the message is corrupted by noise, which could be defined as any aspect of the message that was not intended by the author, the added information is of the kind that Weaver describes as “undesirable,”¹⁹⁴ and Jumarie as “negative information.”¹⁹⁵ By obscuring the author’s intentions, noise could only increase the audience’s uncertainty.

Various aspects of copyright doctrine show the influence of the romantic ideal of authorship. *Feist*, for example, adopts the traditional definition of authors as “originator[s]” and “maker[s].”¹⁹⁶ Copyrightable writings are the “original intellectual conceptions of

190. See Woodmansee, *supra* note 186, at 426 (“In my view the ‘author’ in its modern sense is a relatively recent invention. Specifically, it is the product of the rise in the eighteenth century of a new group of individuals: writers who sought to earn their livelihood from the sale of their writings to the new and rapidly expanding reading public.”).

191. Litman, *supra* note 6, at 1008.

192. Woodmansee, *supra* note 186, at 429.

193. James D.A. Boyle, *The Search for an Author: Shakespeare and the Framers*, 37 AM. U. L. REV. 625, 629 (1988).

194. SHANNON & WEAVER, *supra* note 22, at 19.

195. JUMARIE, *supra* note 21, at 100.

196. *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 346 (1991) (quoting *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 58 (1884)).

the author,”¹⁹⁷ the “*fruits of [the author’s] intellectual labor,*”¹⁹⁸ the embodiment of “intellectual production, of thought, and conception.”¹⁹⁹ The principle most emphasized in *Feist* is that authorship comes from within: it is creation, not discovery.²⁰⁰ On other occasions, the Supreme Court has observed that an author’s work inevitably reflects the “singular inner being” that gave it birth. In *Bleistein v. Donaldson Lithographing Co.*,²⁰¹ the Court rejected the argument that copyrightable works must reach high levels of aesthetic merit. The Court reached this conclusion, in part, because even rather pedestrian works, such as the circus posters at issue in *Bleistein*, embody “the personal reaction of an individual upon nature.”²⁰² “Personality,” the Court said, “always contains something unique.”²⁰³ An author’s personality “expresses its singularity even in handwriting, and a very modest grade of art has in it something irreducible, which is one man’s alone. That something he may copyright”²⁰⁴

A more recent case suggests that the infusion of personality is not only inevitable, even in a “very modest grade of art,” but *necessary* before a work can be considered a copyrightable work of authorship. In *Mitel, Inc. v. Iqtel, Inc.*,²⁰⁵ the Tenth Circuit Court of Appeals considered the copyrightability of Mitel’s “command codes” used to access the features of a telecommunications system. The court affirmed the denial of Mitel’s request for a preliminary injunction, in part because the codes had been assigned arbitrarily to their respective functions:

Mitel’s own witnesses testified to the arbitrariness of the command codes. Scott Harper, a Mitel marketer . . . testified that he selected the numbers arbitrarily, without any attempt to *place his mark on them*. . . . [P]laintiff’s own expert testified that Mitel’s registers

197. *Id.* (quoting *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 58 (1884)).

198. *Id.* (quoting *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 58 (1884)).

199. *Id.* at 347 (quoting *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 58 (1884)).

200. *Id.* (“[F]acts do not owe their origin to an act of authorship. The distinction is one between creation and discovery . . .”).

201. 188 U.S. 239 (1903).

202. *Id.* at 250.

203. *Id.*

204. *Id.*

205. 124 F.3d 1366 (10th Cir. 1997).

were arbitrary and “real close to random,” and that there is no evidence of anyone trying to “*put their mark*” on the codes.²⁰⁶

Because the purported author of the Mitel command codes failed to “put his mark” on those codes, the court could not find “enough originality to distinguish authorship.”²⁰⁷

Authorship, in other words, does not occur unless the author’s “singular inner being” and “individual sensibility” manifest themselves in the work, at least in some minimal degree. This is true, apparently, even when the work is not of a kind that places a premium on “personality.”

Section 106(A) of the Copyright Act, enacted in 1990, allows the authors of certain works of visual art²⁰⁸ to assert their rights to “attribution” and “integrity.” The author can “claim authorship of the work” and prevent misattribution where the author did not create the work.²⁰⁹ Authors can also prevent the use of their names on works that have been subject to “distortion, mutilation, or other modification . . . which would be prejudicial to [the author’s] honor or reputation.”²¹⁰ Under limited circumstances, authors can even prevent such “distortion, mutilation, or other modification” of their works or the destruction of a “work of recognized stature.”²¹¹ One could justify these provisions under a conventional public-benefits theory; protecting the honor and reputation of artists encourages artists to produce copyrightable works for the ultimate benefit of the public. But the protections speak more directly to the romantic notion that an author’s work is inseparable from his unique personality—so much so that mistreatment of the work constitutes mistreatment of the author.

206. *Id.* at 1373–74 (emphasis added).

207. *Id.* at 1374 (citation omitted).

208. The protected works include paintings, drawings, prints, sculptures, and photographs in limited editions. Books, periodicals, motion pictures, advertising art, works for hire, and works produced in large editions (more than 200 copies) are specifically excluded. *See* 17 U.S.C. § 101 (2000).

209. *Id.* § 106A(a)(1).

210. *Id.* § 106A(a)(2).

211. *Id.* § 106A(a)(3). Some of the limitations of that right are set forth at 17 U.S.C. § 113(d) (2000).

B. Challenges to the "Romantic Model"

Although the romantic model of authorship remains a significant undercurrent in copyright law,²¹² postmodernist literary scholars have challenged the traditional emphasis on the author as the focus of criticism. They view art as a more collaborative endeavor, wherein the audience is at least as important as the creator. The "text," they maintain, "is created not in the act of writing but in the act of reading."²¹³ In the words of Roland Barthes,

The removal of the Author . . . is not merely an historical fact or an act of writing; it utterly transforms the modern text (or—which is the same thing—the text is henceforth made and read in such a way that at all its levels the author is absent). The temporality is different. The Author, when believed in, is always conceived of as the past of his own book: book and author stand automatically on a single line divided into a *before* and an *after*. The Author is thought to *nourish* the book, which is to say that he exists before it, thinks, suffers, lives for it, is in the same relation of antecedence to his work as a father to his child. In complete contrast, the modern scriptor is born simultaneously with the text, is in no way equipped with a being preceding or exceeding the writing, is not the subject with the book as predicate; there is no other time than that of the enunciation and every text is eternally written *here and now*.²¹⁴

The "text" is not a reflection of individual genius but an artifact of its cultural environment, a "multi-dimensional space in which a variety of writings, none of them original, blend and clash."²¹⁵ Consequently, the text has no "single 'theological' meaning (the 'message' of the Author-God)."²¹⁶ The "meaning" of the text is whatever we, the audience, find in it.²¹⁷

212. See Ginsburg, *supra* note 146, at 1867 ("[T]he personality concept of copyright continues—often subconsciously, but certainly pervasively—to inform our ideas about copyright today, too often to the exclusion of competing models of copyright.").

213. Jaszi, *supra* note 7, at 458 n.9 (quoting BARTHES, *supra* note 10, at 159).

214. BARTHES, *supra* note 10, at 145.

215. *Id.* at 146 ("The text is a tissue of quotations drawn from the innumerable centres of culture.").

216. *Id.*

217. See Michel Foucault, *What is an Author?*, in *TEXTUAL STRATEGIES: PERSPECTIVES IN POST-STRUCTURALIST CRITICISM* 141, 143 (Josue Harari ed., 1979) ("It is a very familiar thesis that the task of criticism is not to bring out the work's relationships with the author, nor to reconstruct through the text a thought or experience, but rather, to analyze the work

In parallel fashion, some copyright scholars have called for reduced emphasis on the author/genius, recognizing that authors do not, as a rule, produce their works *ex nihilo*. As Professor Litman observes, “authorship in *any* medium is more akin to translation and recombination than it is to creating Aphrodite from the foam of the sea.”²¹⁸ Excessively romantic notions of authorship may lead to copyright laws that are too restrictive, denying the public the benefit of new works produced from the “blend and clash” of existing texts.²¹⁹ If, for example, one regards *West Side Story* as a product of original genius, one may have little sympathy for a subsequent author who recasts the story in a contemporary urban setting. But if one recalls that *West Side Story* is itself an adaptation of *Romeo and Juliet*—Shakespeare’s version of yet another play—the continuation of the work’s evolution in a subsequent text seems less objectionable. When storytelling is viewed as a continuing, collaborative process, the rights of the individual storyteller pale in comparison to the rights of the community.

In many respects, copyright doctrine already distances itself from the romantic model of authorship. Courts have long held that the purpose of copyright is to serve the consuming public, not to defend the rights of authors in their singular personalities or their creative labors. Copyright laws exist “[t]o promote the Progress of Science,” meaning knowledge.²²⁰ While “[t]he immediate effect of . . . copyright law is to secure a fair return for an ‘author’s’ creative labor,” the “ultimate aim is, by this incentive, to stimulate artistic creativity for the general public good.”²²¹ Except, perhaps, in the

through its structure, its architecture, its intrinsic form, and the play of its internal relationships.”).

218. Litman, *supra* note 6, at 966 (“To say that every new work is in some sense based on the works that preceded it is such a truism that it has long been a cliché, invoked but not examined.” (citations omitted)). Allusion to or borrowing from prior works is particularly characteristic of postmodernism. See Kevin J.H. Dettmar, *The Illusion of Modernist Allusion and the Politics of Postmodern Plagiarism*, in PERSPECTIVES ON PLAGIARISM AND INTELLECTUAL PROPERTY IN A POSTMODERN WORLD 99, 104–05 (Lise Buranen & Alice M. Roy eds., 1999).

219. See *supra* note 215 and accompanying text.

220. U.S. CONST. art. I, § 8, cl. 8; see *supra* text accompanying notes 113–14.

221. *Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 156 (1975).

limited case of “moral rights,” the rights of authors are derivative and secondary to the interests of the public.²²²

Copyright law, like contemporary literary theory, often emphasizes the work at the expense of the author.²²³ For example, authors who have been assigned copyrights can be prevented from creating works similar to those they have previously made.²²⁴ The work corresponding to the assigned copyright defines an “imaginative territory” from which even the author can be excluded, thereby limiting the continued exercise of the author’s creative genius.²²⁵ In the case of an assignment one can at least imagine a deliberate and lucrative relinquishment of the author’s rights. However, when the work is a “work for hire,” the “inner being” from which it sprang never enjoys the legal status of “author”; the employer is considered the “author” of the work.²²⁶ The employer/author is hardly a romantic notion; it recalls the pre-romantic conception of authors as instruments—inspired workmen or skilled craftsmen, at best.²²⁷

The vast scope of copyright protection alone undermines any connection with the romantic model of authorship. Copyright is not limited to works of genius. Since *Bleistein*, courts have held themselves incompetent to distinguish between the inspired and the mundane.²²⁸ Nor is copyright limited to the kinds of works likely to exhibit their creators’ personalities. Even a telephone book, if it is not organized in the most obvious fashion, can satisfy the minimal

222. See *Goldstein v. California*, 412 U.S. 546, 555 (1985); *Harper & Row Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 546 (1985); *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 477 (1984) (Blackmun, J., dissenting); *Mazer v. Stein*, 347 U.S. 201, 219 (1954).

223. See *Jaszi*, *supra* note 7, at 475 (“For many purposes, the ‘work’ displaced the ‘author’ as the central idea of copyright law, facilitating the redefinition of the boundary between proprietary control and free public access.”).

224. See *id.* at 478.

225. See *id.* (“Once the penumbral concept of the ‘work’ was firmly in place, the purchasers could acquire a general dominion over the imaginative territory of a particular literary or artistic production. Publishers could use this ‘authority’ to exclude from that territory not only strangers but the very ‘author’ who first delimited it.”).

226. 17 U.S.C. § 201(b) (2000) (“In the case of a work made for hire, the employer or other person for whom the work was prepared is considered the author . . . and, unless the parties have expressly agreed otherwise in a written instrument signed by them, owns all of the rights comprised in the copyright.”).

227. See *supra* note 188 and accompanying text.

228. See *supra* text accompanying note 202.

requirements of originality and creativity.²²⁹ Computer programs are also copyrightable subject matter.²³⁰ Although arguments have been made that programming is more akin to traditional forms of authorship than one would suppose,²³¹ the admixture of utilitarian concerns and technical craftsmanship certainly clouds the picture.

Peter Jaszi complains that the indiscriminate subject matter of copyright, the emphasis on the work, and the reluctance of courts to judge artistic merit “effaces and generalizes ‘authorship,’ leaving this category with little or no meaningful content and none of its traditional associations.”²³² One is certainly entitled to ask what authorship *is*, if it is not the communication of unique thoughts originating somewhere in the author’s own personality. If there is no “magic,” no *ex nihilo* alchemy in the crucible of genius, and if text creation is little more than a patchwork assembly of existing fragments, what does the individual contribute to the text that earns him the title of “the author”? The next section considers some alternatives based on the precepts of information theory.

C. Alternative Models of Authorship

The potential relationship between “originality” in copyright and “entropy” in information theory suggests at least two alternatives to the romantic model of authorship. The first alternative equates authorship with the addition of noise to a signal. The second proposes that authorship, like the addition of information to a message, reflects “freedom of choice” in the selection of one means of expression from a variety of available means. The second alternative is less disparaging of the talents of authors than the first, yet it is still “unromantic” enough to be more inclusive, and less dependent on the notion of genius or personality, than the traditional model.

229. See *Key Publ'ns, Inc. v. Chinatown Today Publ'g Enters., Inc.*, 945 F.2d 509, 514 (2d Cir. 1991) (holding that “Chinese Yellow Pages” met requirement of originality). *But cf.* *BellSouth Adver. & Publ'g Corp. v. Donnelley Info. Publ'g*, 999 F.2d 1436, 1442 (11th Cir. 1993) (en banc) (holding the more conventional “Yellow Pages” directory unoriginal).

230. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1247–49 (3d Cir. 1983).

231. See Anthony L. Clapes et al., *Silicon Epics and Binary Bards: Determining the Proper Scope of Copyright Protection for Computer Programs*, 34 UCLA L. REV. 1493, 1535–36, 1583 (1987).

232. Jaszi, *supra* note 7, at 483.

1. Authors as "noisy channels"

The romantic model of authorship treats the author, in the terminology of information theory, as a "message source."²³³ One could imagine an alternative and pointedly *unromantic* model in which the author is merely a "channel."²³⁴ Imagine an artist who paints a sunset as it occurs and as realistically as he possibly can. The scene is the "message," and the artist, like the canvas, only a medium through which the message is conveyed to its ultimate recipient: the viewer of the painting. Like most channels of communication, the artist is an imperfect medium and introduces "noise." His eyesight is poor, his technique flawed, his materials unequal to the task. Some information is lost as the artist generalizes, perhaps substituting a single shade of orange for the subtle range of hues in the scene before him. Other information is added—even if it is what Weaver would call "undesirable information." For example, the geometrical outlines of a building—regular enough to be compressed by efficient coding into a short message—might be transformed by the artist's unsteady hand into a far more complex figure. Whatever contributes to the painting's *entropy*—its randomness, disorder, and unpredictability—adds *information*, at least as Shannon used the term.²³⁵

Some of the information conveyed by the painting would have its origin in the scene that the artist had observed. The artist would not be the "author" of that information, which would fall in the realm of discovered facts.²³⁶ However, the added information corresponding to the imperfections—the *noise* added in transmission—would be, in some senses, "original." Information theorists speak of "conditional entropy" in the context of message transmission through a "noisy channel." The entropy of the received signal (denoted $H(y)$) is a function of the entropy of the source ($H(x)$) and of any additional entropy added in transmission. The conditional entropy $H_x(y)$ represents the entropy of the received signal "when the input is known."²³⁷ Hence, the conditional entropy reflects information attributable to the noisy channel rather than to

233. See *supra* note 26 and Figure 1.

234. See *supra* text accompanying notes 25–27.

235. See *supra* Part I.A.

236. See *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 347 (1991).

237. SHANNON & WEAVER, *supra* note 22, at 66.

the source. Perhaps one could define the “original” or “authored” aspects of the artist’s painting as equivalent to its conditional entropy.

There is some precedent for equating authorship with noise. In *Alfred Bell & Co. v. Catalda Fine Arts, Inc.*,²³⁸ the Second Circuit Court of Appeals held that the plaintiff’s mezzotint reproductions of public domain paintings were sufficiently original to be copyrighted.²³⁹ In the passage for which the case is remembered, the court observed that

even if [the mezzotints’] substantial departures from the paintings were inadvertent, the copyrights would be valid. A copyist’s bad eyesight or defective musculature, or a shock caused by a clap of thunder, may yield sufficiently distinguishable variations. Having hit upon such a variation unintentionally, the “author” may adopt it as his and copyright it.²⁴⁰

The court provided “inadvertent errors in translation” as an example of a distinguishable, copyrightable variation.²⁴¹

Professor Litman offers “this image of the individual whose apparent creativity is the product of imperfect eyesight, flawed execution, or unrelated circumstances” as “a metaphor for authorship in general.”²⁴² It does, at least, suggest what an individual “author” might contribute to a text that is, in most respects, a cultural or societal undertaking. Moreover, the authorship-as-accident model serves many of the interests of copyright doctrine. The randomizing, or *disordering*, aspect of flawed execution enhances entropy, providing the text with a more distinctive “signature.” If several artists were painting the same sunset, the more their hands trembled and their paint dripped the more each painting would be uniquely identifiable. That would prove useful to an artist who charged that his work had been infringed by copying, because an accused infringer would find it difficult to explain why the plaintiff’s mistakes also appeared in her own work.²⁴³ More

238. 191 F.2d 99 (2d Cir. 1951).

239. *Id.* at 104.

240. *Id.* at 105 (citations omitted).

241. *Id.* at 105 n.25.

242. Litman, *supra* note 6, at 1010.

243. Authors sometimes deliberately include “mistakes” in their works, such as false streets in an atlas or invented telephone listings in a directory, in order to more easily detect

importantly, treating the noise alone as “original” would preserve the dichotomies that are so fundamental to copyright doctrine.²⁴⁴ Noise is comfortably within the realm of expression, at least as contrasted to facts or ideas. Exclusive rights to noise take nothing from the public domain nor do they limit the opportunities of subsequent authors.

The “noisy channel” model stands in sharp contrast to the romantic model of the author/genius. The least-skilled author would qualify as the most “original” and could most easily enforce his rights. If the noise were actually random—as it would need to be to maximize entropy—nothing distinctive of the author or his personality could be identified in the “authored” aspects of the work. While random information tends to be unique, the overall effect is one of sameness.²⁴⁵ Nor could authorship any longer be equated with the transmission of meaning from author to audience. If the audience discovered any meaning in an accidental variation, it would have to be accidental meaning, as if typing monkeys chanced to produce a coherent text.²⁴⁶

The “noisy channel” author is such an insignificant figure²⁴⁷ that one might wonder whether he has earned any legal rights. He may

copying. See *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 344 (1991); *Nester's Map & Guide Corp. v. Hagstrom Map Corp.*, 796 F. Supp. 729, 732–33 (E.D.N.Y. 1992). Street addresses in a directory were changed, in part to detect copying; nevertheless, the court employed a theory of “copyright estoppel” to hold those facts uncopyrightable as though they had been genuine. *Id.*

244. See *supra* Part II.B.

245. See *PIERCE*, *supra* note 19, at 251 (“Mathematically, white Gaussian noise, which contains all frequencies equally, is the epitome of the various and unexpected. It is the least predictable, the most original of sounds. To a human being, however, all white Gaussian noise sounds alike. Its subtleties are hidden from him, and he says that it is dull and monotonous.”). A random visual image would resemble the snow on a television set in the absence of a broadcast signal—“gray, perpetually agitated, foggy undulation with little, capricious, constantly changing outlines.” *MOLES*, *supra* note 1, at 61. Because the image “contains too much information . . . it exceeds our capacity for understanding and creates boredom.” *Id.*

246. Eighteenth-century satirist Jonathan Swift described a machine for producing random strings of words, from which, it was hoped, “a complete body of all arts and sciences” might be pieced together. *JONATHAN SWIFT, GULLIVER'S TRAVELS*, in *GULLIVER'S TRAVELS AND OTHER WRITINGS* 23, 180–81 (Miriam Kosh Starkman ed., Bantam Books 1981) (1726).

247. Professor Jaszi, discussing the “distinguishable variation” test of *Alfred Bell*, argues that “[t]he nature of any creative investment in the variations is, as a practical matter, simply irrelevant to the outcome, save in one respect: the variations must be traceable to a human actor; they cannot arise from mere mechanical mishaps.” Jaszi, *supra* note 7, at 484. Even that might overstate the case. It would be hard to separate the “distinguishable variation” created

have invested some labor in his clumsy efforts, but compensation for labor or “sweat of the brow” has been rejected as a theoretical basis for copyright, at least in the context of rewarding the labor expended in discovering uncopyrightable facts.²⁴⁸ On the other hand, the careless author might discover a variation that is not only distinguishable but also pleasing. Noise ceases to be a background distraction and becomes a foreground point of interest if the audience is willing to regard it in that fashion.²⁴⁹ More of these noisy variations will be discovered, to the ultimate benefit of the consuming public, if authors have a financial incentive to keep working.²⁵⁰ At any rate, we could use such arguments to justify authorial rights in works that are genuinely random or indeterminate.²⁵¹

The “noisy channel” model might satisfy some literary theorists; it minimizes the human presence of the author and, by default, emphasizes the characteristics of the work and the audience’s reaction to it.²⁵² Yet it offers an incomplete picture of what authors

by the slip of the painter’s brush from a similar variation created by a paper jam in a photocopier, except that it might be easier to identify the person who had held the brush than the person responsible for jamming the machine. On the other hand, *some* participation by a human actor in the creation of the work aids in distinguishing between copyrightable writings and uncopyrightable discoveries, even if the distinction is somewhat arbitrary. See Alan L. Durham, *The Random Muse: Authorship and Indeterminacy*, 44 WM. & MARY L. REV. 569, 636–38 (2002).

248. See *Feist*, 499 U.S. at 352–53 (reasoning that the “sweat of the brow” theory is based on the mistaken notion “that copyright [is] a reward for the hard work that went into compiling [the] facts”).

249. Such is the rationale behind composer John Cage’s notorious 4’33”, a work in which a pianist or other performer sits in silence while the audience experiences the ambient noises of the auditorium. See PAUL GRIFFITHS, OXFORD STUDIES OF COMPOSERS (18): CAGE 28 (1981) (“4’33” was thus not just a comic stunt but a demonstration that the sounds of the environment have a value no less than that of composed music, for in truth there is no silence . . .”); MOLES, *supra* note 1, at 100 (“Noise can be logically defined only on the basis of *intent*. A noise is a message that someone does not want to transmit or to receive. . . . When the receptor is an individual and the transmitter the external world, the concept of intent gives way to that of *choice*, that is, of value judgment.”); MICHAEL NYMAN, EXPERIMENTAL MUSIC: CAGE AND BEYOND 53 (1981) (“Cage had found that ‘silence’ is full of (unintentional) sounds which may be of use to the composer and listener . . .”).

250. Many of these variations would be worthless, but the public can simply decline to purchase them.

251. See Durham, *supra* note 247, at 632–33.

252. See Jaszi, *supra* note 7, at 484 (explaining that the “distinguishable variation” test derived from Alfred Bell “is one that focuses attention on the work, rather than on its ‘author’”).

do, even if authorship is regarded primarily as a process of rearranging or transforming materials found in prior works or in nature. As Professor Litman observes, not all of the transformation is accidental: “[s]ome of [it] is purposeful,”²⁵³ and “much of it is the product of an author’s peculiar astigmatic vision.”²⁵⁴ Even the latter is “peculiar” to the individual author—it is not *random* noise but noise distinctive of its source, as recent efforts to identify anonymous authors by their stylistic quirks have demonstrated.²⁵⁵ More importantly, most authors are not, like the hypothetical painter, attempting to transmit a flawless reproduction of external phenomena. Some forms of authorship, such as fiction or music, communicate information about the world only in the most general sense. Even the relatively objective art of photography mixes accurate depiction with personal expression.²⁵⁶ To the extent that an author is a “channel,” much of what is “channeled” seems to come from within. Hence, a more promising, more inclusive alternative to the romantic model of authorship is a model inspired by the association of information and freedom of selection.²⁵⁷

2. *Authorship as unconstrained selection*

As previously discussed,²⁵⁸ some information theorists treat Shannon’s H as a measure of the message sender’s freedom to select from among an array of alternative messages. The information content of a message is inversely proportional to the constraints placed on the message source, either by the redundancy built into the code (e.g., if the first letter is q , the next must be u) or by characteristics of the situation that produce a more predictable message (e.g., peach pie as usual). Such constraints are partially responsible for the selection of a particular message. The message recipient might not be aware of those constraints. The recipient might think, initially, that all letters are equally likely to follow q or that a customer is as likely to order one flavor of pie as another.

253. Litman, *supra* note 6, at 1010.

254. *Id.*

255. See DON FOSTER, *AUTHOR UNKNOWN* (2000).

256. See *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 60 (1884) (concluding that a photograph of Oscar Wilde was “the product of plaintiff’s intellectual invention”).

257. See *supra* text accompanying notes 69–73.

258. See *supra* text accompanying notes 69–73.

Eventually, the patterns emerging in a series of messages would reveal such constraints to the recipient, rendering the content of the messages more predictable and reducing the recipient's perception of the information content of those messages.

One could devise a similar selection-oriented definition of authorship. An author is in some respects a source, a channel, and an encoder.²⁵⁹ In each role, an author exercises choice. An author chooses the ideas to be included in the work and chooses how they will be expressed.²⁶⁰ "Authorship" might be defined as the process of selection applied to the attributes of a writing.²⁶¹ A text freely selected from among an array of alternatives could be considered an "original work of authorship," in contrast to an "inevitable" and therefore unoriginal text, like the *Feist* telephone directory.²⁶²

Writers, illustrators, composers, and "authors" of every other stripe constantly engage in the process of selection. In *Burrow-Giles*, for example, the Court held a photograph of Oscar Wilde to be an "authored" work because of the choices the photographer had made in pose, lighting, costume, props, and so forth.²⁶³ Even when the means of expression are not under the author's complete control—e.g., the paint drips or a finger slips on the keyboard—the author ultimately chooses to "adopt" the uninvented variation or to discard it and try again. At the same time, an author's selections are constrained, or certain selections made more probable, by a variety of circumstances. Most authors employ existing languages or styles, which by their conventions add a certain amount of "redundancy" to the expression.²⁶⁴ Once the choice of subject has been made, authors

259. See *supra* Figure 1.

260. The amendments, excisions, and substitutions often found in handwritten manuscripts show that process of selection at work. See, e.g., THE PIERPONT MORGAN LIBRARY, A CHRISTMAS CAROL BY CHARLES DICKENS: A FACSIMILE OF THE MANUSCRIPT IN THE PIERPONT MORGAN LIBRARY (James H. Heineman, Inc. 1967) (1843).

261. This refers to "writing" in the broad sense in which "writing" is used in the copyright statutes. See *supra* text accompanying notes 115–16.

262. We will assume, for purposes of discussion, that the alphabetical arrangement of telephone subscribers is as routine and inevitable as the court suggests. Professor Nimmer disputes that. See Nimmer, *supra* note 11, at 97–98 (arguing that the alphabetizer makes so many choices that each directory is necessarily "a profoundly unique compilation").

263. *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 60 (1884).

264. An information theorist would regard an author's own style as a form of constraint that diminishes the information content of his message. If a listener were intimately familiar with the style of a particular composer, the listener might guess in advance how a new piece would sound or, once it had begun, how it might progress. Such stylistic attributes might

who depict external phenomena are further limited by what they observe. However, few authors are so constrained by such factors that we could predict in advance the choices they would make. Those choices may be the product of influences so varied and so personal to a particular author that they almost defy explanation:

What does influence the choice among words when the words used in constructing grammatical sentences are chosen, not at random by a machine, but rather by a living human being who, through long training, speaks or writes English according to the rules of grammar? This question is not to be answered by a vague appeal to the word *meaning*. Our criteria in producing English sentences can be very complicated indeed.²⁶⁵

An author's choices might be attributed to inspiration or incompetence. Some choices might be genuinely haphazard. The important thing, so far as this model of authorship is concerned, is that selection has occurred.

The concept of authorship as selection, and originality as freedom from constraint, would not be entirely new to copyright law. Factual compilations are currently recognized as copyrightable, even though the facts themselves are not, if the facts are "*selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship.*"²⁶⁶ The selection is original as long as it is chosen from an array of alternatives, and it is not, like the selection of telephone numbers in *Feist*, a foregone conclusion. The approach I suggest would extend the compilations model to other forms of authorship.

Emphasis on selection is not inconsistent with the romantic ideal of authorship. The romantic qualities of personality, individualism, and genius could be expressed through selection. Only Leonardo, one could say, would have chosen such an expression for his Mona Lisa. However, one can imagine a selection-based model of authorship as neutral—even "unromantic"—like the models of

diminish information, but they should not be discounted as an aspect of authorship. Selections driven by the author's personal inclinations are a clear example of authorial expression, in contrast to selections driven by existing conventions that the author merely adopts. Of course, one must still bear in mind the prohibition on copyrighting ideas or systems of expression, which, original or not, are so general that public policy demands their general availability.

265. PIERCE, *supra* note 19, at 116.

266. 17 U.S.C. § 101 (2000) (emphasis added).

information theories concerning the transmission of data. The information content of a message does not depend on the genius, or lack thereof, of the message source. Shannon's H is solely a measure of the array of possible messages and their statistical probability. Because information is a function of disorder, the unskilled improvisations of a keyboard novice might contain more information than a classical fugue. Even a random message generated by a mechanical source would be rich in information; here we would not speak of information in terms of the source's freedom of choice, but rather in terms of the recipient's uncertainty based on inability to predict the characteristics of the message.²⁶⁷ We could similarly define "original works of authorship" purely in terms of selection from an array of alternatives, ignoring the romantic or unromantic origins of the selection.

In important respects, an unromantic, selection-based model of authorship would parallel contemporary literary theory. It would focus attention on the work rather than the author. Originality would be a characteristic of the text—or, more precisely, of the text in the context of the available alternatives—just as information is a characteristic of a message, not of the message sender. A work created by accident or by a clumsy novice might be as original, or more original, than one created by the deliberate actions of a "genius." Because selection operates on preexisting materials, authorship also would not require the romantic model's notion of creation *ex nihilo*. Finally, the selection-based model could dispense with the romantic idea of authorship as the communication of meaning—specifically, the meaning intended by the author.²⁶⁸ Meaning imposes order, restricts choice, and decreases entropy. Weaver's "vague feeling" that information and meaning might be "subject to some joint restriction that condemns a person to the sacrifice of the one as he insists on having much of the other"²⁶⁹ might be more persuasively applied to authorship and meaning. The more meaning an author wishes to convey, the fewer choices he may have. The meaningless affords greater room for originality (in this limited sense) than the meaningful.

267. See *supra* notes 75–79 and accompanying text.

268. See *supra* text accompanying note 216.

269. SHANNON & WEAVER, *supra* note 22, at 28.

As discussed in Part II.B, the subject of limited choices usually arises in copyright law in the context of merger. If facts or ideas can be expressed in so few ways that copyright on the expression threatens to monopolize the facts or ideas, the doctrine of merger denies copyright even to the expression.²⁷⁰ In *Mitel, Inc. v. Iqtel, Inc.*,²⁷¹ the plaintiff pointed out that because its command codes were “arbitrary,” they “could have been written in a variety of different ways, not only the way that was chosen by [its] engineers.”²⁷² The court brushed this aside in the course of finding the command codes “unoriginal” and faulted Mitel for “fail[ing] to recognize that originality is an independent requirement that is not satisfied merely because the merger doctrine is inapplicable.”²⁷³

The concepts of originality and merger *are* unrelated *if* originality is dependent on the romantic notion of authorship as an expression of the author’s personality or if a work of authorship must be the product of an author’s intellectual labor.²⁷⁴ A form of expression chosen at random from a large number of available forms of expression would present no issue of merger, even though the work required no effort to produce and bore no evidence of the author’s personality. On the other hand, if the only purpose of the originality requirement is to distinguish private property from the public domain in the manner that most benefits the public, it would not be surprising to find a close relationship between originality and merger. The principle of merger ensures that private rights do not frustrate the progress of knowledge by denying authors access to facts and ideas. It is a corollary, in part, to the fact/expression dichotomy, by which *Feist* defines the concept of authorship.²⁷⁵ Hence, the absence of merger might go far toward demonstrating the presence of authorship/originality.²⁷⁶

One could go overboard in equating originality with absence of constraint, along the lines suggested by the relationship between information and entropy. Inevitably, some forms of expression are

270. See *supra* text accompanying notes 157–69.

271. See *supra* text accompanying notes 205–07.

272. *Mitel, Inc. v. Iqtel, Inc.*, 124 F.3d 1366, 1373 n.6 (10th Cir. 1997).

273. *Id.*

274. See Durham, *supra* note 247, at 607–23.

275. See *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 347–48 (1991).

276. Note that an original *idea* alone cannot avoid merger, because other authors must be permitted to express that same idea.

preferable to others and are chosen for that reason. If one form of expression is preferred, even based on purely aesthetic considerations, an information theorist might consider that sufficient to bias the probabilities toward that form of expression, thereby reducing the information content of the message. One could even regard each form of expression as unique in its ability to affect the “conditional probability matrix” of the recipient,²⁷⁷ if that includes the way the message affects the recipient’s emotions or sensibilities. At the same time, one could dispute the freedom of a human author to choose any expression other than the one the author *did* choose. In the context of information theory, David L. Ritchie observes that every aspect of a message has an antecedent cause and that the more one knows about those causes, the less information the message bears.²⁷⁸ One could argue, similarly, that authors really have little choice in what they select; if one knew enough about the author, one could see that every choice was predetermined, unless the author employed some random process such as flipping a coin.²⁷⁹

Such reasoning could lead to the absurd conclusion that *only* random selections are original and only those who employ a pair of dice or its equivalent are truly authors. But unless the work is of the kind where very few choices are possible, no observer could predict in advance—or even after experiencing a portion of the work—how the expression will be realized. That would be sufficient for the work to convey “information” to its audience,²⁸⁰ and it should be sufficient as well to demonstrate the presence of originality, assuming

277. See *supra* text accompanying note 99.

278. See PIERCE, *supra* note 19, at 61 (“Perhaps if we knew enough about a man, his environment, and his history, we could always predict just what word he would write or speak next.”); RITCHIE, *supra* note 1, at 46 (“If everything that can possibly be known about the context, including the speaker’s and the listener’s full psychological and social history, could be included in the calculation of conditional probabilities, the structural redundancy of typical messages in a natural language would probably increase well beyond the 70% that has been estimated on the basis of grammatical structure alone. If every behavior is fully caused by antecedent events, as scientists commonly assume, then a full account of external structure would increase structural redundancy to 100% and reduce H to zero.”).

279. Composer John Cage often flipped coins to determine the attributes of his music. See generally CHRISTOPHER SHULTIS, *SILENCING THE SOUNDED SELF* 93 (1998).

280. See PIERCE, *supra* note 19, at 61–62 (“[W]e can derive certain statistical data which, as we have seen, help to narrow the probability as to what the next word or letter of a message will be. There remains an element of uncertainty. For us who have incomplete knowledge of it, the message source behaves *as if* certain choices were made at random, insofar as we cannot predict what the choices will be.”).

that the unpredictability is a property of the expression rather than of the facts or ideas expressed.

Probably no works that have been held copyrightable, applying romantic notions of authorship, need be held uncopyrightable applying this less romantic model. On the other hand, some works that have been held *lacking* in authorship under the romantic model—works created by arbitrary, indeterminate, or mechanical means—might qualify as original works of authorship under an unromantic, selection-oriented model. The command codes in *Mitel*, for example, might not have been created by any process that qualifies as romantic authorship,²⁸¹ but if the standard of originality is based on the availability of alternatives, the codes would plainly qualify for copyright protection. In fact, copyright protection would be easier to justify than if the codes, as the court seemed to desire, “meant something.”²⁸²

A selection-based model of authorship would have to operate in conjunction with the traditional dichotomies of copyright law. Freedom to select from a variety of facts to report (e.g., the population of one town among thousands) should not give the reporter a copyright monopoly on the selected fact.²⁸³ The idea/expression dichotomy also must play its traditional, policy-oriented role. The choices of expression available to an author depend upon the level of abstraction at which the idea of the work is defined.²⁸⁴ One could still *begin* with the question of originality by considering the range of possible texts of which the work at issue is one example, but one would have to ensure that the freedom of selection existed at the specific level of expression as well as at the general level of idea. No less is required today in order to determine

281. See *supra* text accompanying note 206.

282. Copyrighting *any* industry-standard codes or part numbers would impact competition in markets distinct from that for the copyrightable expression—a problem that might warrant some form of “fair use” exception. See William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 352 (1989) (“We hope the debate [over the copyrightability of industry standard computer interface screens] will be resolved not by the semantics of the words ‘idea’ and ‘expression’ but by the economics of the problem and, specifically, by comparing the deadweight costs of allowing a firm to appropriate what has become an industry standard with the disincentive effects on originators if such appropriation is forbidden.”).

283. Selection of a *subset* of facts from a larger universe may constitute a form of expression. See *supra* text accompanying note 150.

284. See *supra* text accompanying note 169.

whether the selection of material renders a compilation an original work of authorship.

An unromantic, text-oriented model of authorship would require some reinterpretation of the landmark *Feist* decision. *Feist*, to a degree, perpetuated the romantic model of authorship by requiring “a modicum of intellectual labor” in copyrightable works²⁸⁵—a condition that directly concerns the process of creation rather than the attributes of the text—and by demanding “creativity,”²⁸⁶ a concept evocative of the “magical” qualities of the author/genius. On the other hand, *Feist* dismissed labor (or “sweat of the brow”) as a justification for copyrighting facts,²⁸⁷ so one can infer that the “intellectual labor” invested in expression is required, not for its own sake, but to ensure that the expression is unique rather than “inevitable.” *Feist* also held that the alphabetical organization of the plaintiff’s telephone directory lacked “the minimal creative spark required by the Copyright Act and the Constitution” because that organization was “an age-old practice, firmly rooted in tradition and so commonplace that it has come to be expected as a matter of course.”²⁸⁸ If the organization is “expected as a matter of course,” it does not embody the *unexpectedness* that would be the hallmark of originality under the alternative model of authorship. One could, therefore, adjust the reasoning of *Feist* just enough to make creative labor *one means* of achieving an unpredictable/original result rather than the *only* acceptable means. This would be consistent with the fundamental goal of *Feist*, which is not to reward the labor of authors or to defend their personality interests but, rather, to promote the public interest by balancing legal rights in expression against the exhaustible resources of the public domain.²⁸⁹

285. *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 347 (1991) (“[A] modicum of intellectual labor . . . clearly constitutes an essential constitutional element.” (quoting 1 MELVILLE B. NIMMER & DAVID NIMMER, *NIMMER ON COPYRIGHT* § 1.08[C][1]) (1990)) (alterations in original); see also *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 59–60 (1884) (referring to “intellectual production . . . thought, and conception” as attributes of authorship); *The Trade-Mark Cases*, 100 U.S. 82, 94 (1879) (requiring “work of the brain”).

286. *Feist*, 499 U.S. at 345–46.

287. *Id.* at 352–53.

288. *Id.* at 363 (emphasis added).

289. See Durham, *supra* note 247, at 621–23.

IV. CONCLUSION

Authorship is seldom an exercise in unlimited freedom. For a variety of reasons, including the practicalities of communicating with an audience, authors subject themselves to certain constraints. An English-speaking poet commemorating the Battle of Hastings will find his expression directed, to a degree, by the conventions of English vocabulary, syntax, punctuation, and spelling; by his chosen meter and rhyme scheme; and by the fact that the Normans won. An information theorist would find much in the poem that was, in the specialized sense, "redundant." Yet another poet, subject to the same constraints of language, form, and history, would likely produce an easily distinguishable text. Unless an author is working in a very restrictive form, like an alphabetical list, there is much expression to choose from, and each author will choose differently. In such selection resides the "information" conveyed by the poem.

The romantic model of authorship attributes such selection to the operation of the author's individual genius or, at the very least, individual personality. Judicial decisions that require evidence of some "work of the brain" or a personal "stamp" in order to find that a work of authorship is "original" reflect that romantic model. As we have seen, literary theorists question the validity of the romantic model, preferring to focus on the possibilities inherent in the text rather than on the inspiration of the text's creator. Copyright law, intended to reflect the interests of the public rather than the natural rights of the author/genius, may also be best served by a less-romantic, more text-oriented model of originality. A promising source for such a model is Shannon's conception of "information," which is meaning-neutral and, so to speak, genius-neutral. It distinguishes between the "redundant" aspects of a message, which are expected or predetermined, and the unpredictable, spontaneous aspects that convey information. Shannon's approach is close in spirit and in fact to the distinction that copyright doctrine draws through the concepts of authorship, originality, and creativity.

If copyright were to sever its remaining ties to the romantic model in favor of the more neutral, selection-oriented criteria previously discussed, a wider array of texts would be copyrightable, including those that are rich in "information" precisely because they were *not* produced by the ordered thought processes and restrictive predilections of an author/genius. As a random message embodies the highest level of "information," one could argue that it also

embodies the highest level of “originality.” That is not a ridiculous conclusion, if the point of “originality” is to ensure that exclusive rights to the copyrighted work still leave “enough and as good”²⁹⁰ for the use of society and subsequent authors. The least-ordered texts are also the most abundant and probably the least essential as material for the public domain. This might cheapen authorship in some fashion, including works within the realm of copyright that many would consider unworthy of the honor. However, once those rights are secured, the marketplace can determine what is and is not valuable.

I take seriously those information theorists who caution against using Shannon’s theories indiscriminately in fields where they do not belong.²⁹¹ It is certainly the case that copyright policy should be determined by the practical objectives of promoting knowledge and stimulating public discourse, rather than by forced analogy to a mathematical insight, however fundamental that insight may be. On the other hand, information theory suggests an intriguing substitute for the much-criticized romantic model of authorship, a substitute not too far removed from the accepted principles of copyright doctrine; originality, like information, is not a product of genius, but of freedom. Those who question the traditional model of authorship, confined as it is by its romantic subtext, may find this a fruitful alternative.

290. Writing in the context of natural rights, John Locke qualified his position that property rights could be based on the mixture of labor and material taken from the commons with the “proviso” that “enough and as good [be] left in [the] common[s] for others” to exploit. JOHN LOCKE, *THE SECOND TREATISE OF GOVERNMENT* 17 (Thomas P. Peardon ed., The Bobbs-Merrill Co., 1952) (1690). That proviso plays an important role in modern thinking regarding rights in intellectual property. See, e.g., Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 *YALE L.J.* 1533, 1565, 1560–72 (“Locke here takes a step that helps to justify an exclusion right, for, with the proviso satisfied, the public’s fundamental entitlements will not be impaired if the owner excludes it from the owned resource.”).

291. See, e.g., PIERCE, *supra* note 19, at 229 (“I [have read] a good deal more about information theory and psychology than I can or care to remember. Much of it was a mere association of new terms with old and vague ideas. Presumably the hope was that a stirring in of new terms would clarify the old ideas by a sort of sympathetic magic.”) (alteration in original).

