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Digital Habit Evidence

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DIGITAL HABIT EVIDENCE

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ABSTRACT

This Article explores how "habit evidence" will become a catalyst for a new form of digital proof based on the explosive growth of smart homes, smart cars, smart devices, and the Internet of Things. Habit evidence is the rule that certain sorts of semiautomatic, regularized responses to particular stimuli are trustworthy and thus admissible under the Federal Rules of Evidence ("FRE") 406 "Habit; Routine Practice" and state equivalents.

While well established since the common law, "habit" has made only an inconsistent appearance in reported cases and has been underutilized in trial practice. But intriguingly, once applied to the world of digital trails and the Internet of Things, this long dormant rule could transform our "quantified lives" into a significant new evidentiary power. In fact, habit evidence as quantified fact may become weaponized to reimagine trial practice in the digital age.

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INTRODUCTION

All humans develop habits, good and bad.[1] These patterns of behavior mark us and shape our activities. In a digital world, these habits are also now measurable, quantifiable, and incredibly revealing.[2] Quite literally, the Internet of Things allows consumers to record daily

1. *See generally* CHARLES DUHIGG, THE POWER OF HABIT: WHY WE DO WHAT WE DO IN LIFE AND BUSINESS (2014) (describing how habits form in our brains).

2. *See, e.g.*, DEBORAH LUPTON, THE QUANTIFIED SELF: A SOCIOLOGY OF SELF-TRACKING 2–6 (2016) (describing the rise of self-tracking and the quantified-self movement).

routines as trackable patterns.[3] In smart homes, sensors monitor family life: when the lights turn off, when the music turns on, when the bath is run, when the garage doors close, when the toothbrush spins, when the alarm rings.[4] In a smart car, speed, distance, time, and location are all recorded by locational tracking services, such that insurance companies can now offer discounts for safe driving in real time.[5] Smart health devices measure our heartbeats, oxygen levels, and daily steps to provide us some picture of our overall fitness.[6] Smart objects answer our questions and order milk when the fridge runs out.[7] Almost all of our communications now connect through a smartphone, tablet, or

3. *See generally* Andrew Guthrie Ferguson, *The Internet of Things and the Fourth Amendment of Effects*, 104 CALIF. L. REV. 805, 813 (2016) [hereinafter Ferguson, *The Internet of Things and the Fourth Amendment of Effects*] (providing a brief history of the Internet of Things ["IoT"]); Scott R. Peppet, *Regulating the Internet of Things: First Steps Toward Managing Discrimination, Privacy, Security, and Consent*, 93 TEX. L. REV. 85, 98 (2014) (describing Internet of Things technologies); Kelsey Finch & Omer Tene, *Welcome to the Metropticon: Protecting Privacy in a Hyperconnected Town*, 41 FORDHAM URB. L.J. 1581, 1599 (2014) ("The 'Internet of Things' is the newest wave in ubiquitous computing, a term used to describe the array of internet-enabled devices . . . that are entering our everyday lives. These devices not only collect increasingly specific personal information; but they also can share that data with other people and other devices." (footnotes omitted)).

4. *See generally* Gabriel Bronshteyn, Note, *Searching the Smart Home*, 72 STAN. L. REV. 455, 459–60 (2020) (outlining the variety of sensors in modern homes).

5. Geoffrey A. Fowler, *What Does Your Car Know About You? We Hacked a Chevy To Find Out*, WASH. POST (Dec. 17, 2019, 7:00 AM) [hereinafter Fowler, *What Does Your Car Know About You?*], https://www.washingtonpost.com/technology/2019/12/17/what-does-your-car-know-about-you-we-hacked-chevy-find-out [https://perma.cc/PR2K-LAUT]; Alexander B. Lemann, *Coercive Insurance and the Soul of Tort Law*, 105 GEO. L.J. 55, 61 (2016) ("Several large car insurance companies offer their customers potential discounts on premiums in exchange for voluntarily using telematics devices and, in some cases, their own smartphones to monitor their driving behavior in real time and send the resulting data to the insurer.").

6. *See generally* Adam D. Thierer, *The Internet of Things and Wearable Technology: Addressing Privacy and Security Concerns Without Derailing Innovation*, 21 RICH. J.L. & TECH. 6, 21–23 (2015) (describing the growth of wearable fitness devices for health); *see also* Hillary Brill & Scott Jones, *Little Things and Big Challenges: Information Privacy and the Internet of Things*, 66 AM. U. L. REV. 1183, 1190–92 (2017) (describing the wired body).

7. *Out of Milk? LG's New Smart Fridge Will Let You Know*, NBC NEWS (May 7, 2014, 2:05 PM), https://www.nbcnews.com/tech/gift-guide/out-milk-lgs-new-smart-fridge-will-let-you-know-n99531 [https://perma.cc/7Z4F-9WGF]; Tomer Kenneth, *Personalization of Smart-Devices: Between Users, Operators, and Prime-Operators*, 70 DEPAUL L. REV. 497, 499 (2021) (explaining that "[s]mart-fridges' innovative technologies facilitate various functions that traditional fridges do not," including "the digital operation of the traditional functions of the fridge, . . . various sensors that collect information from inside the fridge and its surroundings, . . . connection to personal assistants' services such as Alexa or Google Assistant, . . . and a connection to other internet services").

computer—tracking usage, location, and content through email, text, video, or chat.[8]

Beyond our personal lives, our workplaces are being monitored: access cards mark when we clock in and out, warehouses know exactly where and what workers are doing, delivery vehicles are geotracked, hospitals record the location of nurses through radio frequency identification device ("RFID") badges, and employers track productivity by monitoring our computer key strokes.[9] As employers look for ways to maximize output, new services are being invented to augment worker surveillance.[10] One company even went so far as to suggest implanting microchips in its employees to track their workplace patterns.[11]

These digital trails—revealing of private habits and workplace practices—will soon become evidence in court. After all, because many civil and criminal trials turn on finding facts in the absence of human witnesses or physical proof, digital evidence will become central to filling in the gaps. Sometimes these digital clues will be in the form of direct evidence. For example, the black box data recording of a speeding car might reveal the exact speed before impact.[12] But other times, the direct evidence will be missing, and litigants will need to fill the gaps with inferences from past acts and patterns.[13]

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8. *See generally* Andrew Guthrie Ferguson, *The "Smart" Fourth Amendment*, 102 CORNELL L. REV. 547, 557 (2017) [hereinafter Ferguson, *The "Smart" Fourth Amendment*] (discussing the digital trails created by smart devices).

9. *See, e.g.*, Alan Butler & Enid Zhou, *Disease and Data in Society: How the Pandemic Expanded Data Collection and Surveillance Systems*, 70 AM. U. L. REV. 1577, 1615–16 (2021) (providing examples of employer surveillance, including keystroke monitoring); McKay Cunningham, *Exposed*, 2019 MICH. ST. L. REV. 375, 394 (describing corporate surveillance technologies).

10. *See generally* Ifeoma Ajunwa, Kate Crawford & Jason Schultz, *Limitless Worker Surveillance*, 105 CALIF. L. REV. 735, 770 (2017) (detailing more pervasive worker surveillance through technological advances); Colin Lecher, *How Amazon Automatically Tracks and Fires Warehouse Workers for 'Productivity*,' VERGE (Apr. 25, 2019, 12:06 PM), https://www.theverge.com/2019/4/25/18516004/amazon-warehouse-fulfillment-centers-productivity-firing-terminations [https://perma.cc/6M7T-MGA7] (explaining Amazon's system for worker productivity).

11. Peter Holley, *This Firm Already Microchips Employees. Could Your Ailing Relative Be Next?*, WASH. POST (Aug. 23, 2018, 4:48 PM), https://www.washingtonpost.com/technology/2018/08/23/this-firm-already-microchips-employees-could-your-ailing-relative-be-next [https://perma.cc/EL5N-Z27S].

12. Matos v. State, 899 So. 2d 403, 405, 407 (Fla. Dist. Ct. App. 2005) (allowing evidence of an event data recorder, also called the black box, to be introduced into evidence).

13. For example, in a negligence suit against Tesla involving the fatal crash of two young men, Tesla introduced evidence that the drivers had been routinely reckless, driving over ninety

This Article examines this secondary form of evidence, namely how the oft-ignored concept of "habit evidence"[14] can become a catalyst for a new form of digital proof based on those revealed patterns. Under Federal Rules of Evidence ("FRE") 406 "Habit; Routine Practice" and state equivalents, certain sorts of semiautomatic, regularized responses to particularized stimuli are generally trustworthy and thus admissible in court.[15] From biting your nails when you read, to ordering the same large coffee with four sugars every morning, habits are the acts we do so regularly that we can reliably count on it happening again. In one of the most famous recitations of the concept, Professor Charles T. McCormick describes habit evidence as:

> [A] person's regular practice of meeting a particular kind of situation with a specific type of conduct, such as the habit of going down a particular stairway two stairs at a time, or of giving the hand-signal for a left turn, or of alighting from railway cars while they are moving. The doing of the habitual acts may become semi-automatic.[16]

While long established in the common law and then in the Federal Rules of Evidence, habit evidence has made only an inconsistent appearance in reported cases and has been underutilized in trial practice.[17] But interestingly, once applied to the world of digital trails and the Internet of Things, this long dormant rule could transform our "quantified lives" into a significant new evidentiary power.[18] In fact, habit evidence as quantified fact may become weaponized to reimagine trial practice in the digital age.

This Article examines the history, theory, and practice of an old evidentiary rule made newly relevant by the "Internet of Evidence."[19]

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miles an hour almost every day in the months before the crash. The evidence suggesting that the drivers were routinely driving in excess of the speed limit helped limit Tesla's liability. Mark Harris, *The Radical Scope of Tesla's Data Hoard*, IEEE SPECTRUM (Aug. 3, 2022), https://spectrum.ieee.org/tesla-autopilot-data-scope [https://perma.cc/67UT-ETQY].

14. As Part I discusses, habit evidence arose out of the common law tradition and has been formally codified in FRE 406. *See* FED. R. EVID. 406.

15. *Id.*

16. CHARLES T. MCCORMICK, HANDBOOK OF THE LAW OF EVIDENCE § 162, at 341 (1st ed. 1954). The drafters of FRE 406 used this quotation to explain habit evidence. *See* FED. R. EVID. 406 advisory committee's note (quoting McCormick to describe habit).

17. *See infra* Part I.A.1 & C.

18. *See infra* Part II.

19. Andrew Guthrie Ferguson, *Structural Sensor Surveillance*, 106 IOWA L. REV. 47, 63 & n.81 (2020) [hereinafter Ferguson, *Structural Sensor Surveillance*] (acknowledging the term).

This Article argues that a new world of digital tracking confirms the intuition that gave rise to habit evidence. This Article shows how digital trails arising from the Internet of Things reveal and predict habits that, in turn, will manifest as new forms of evidentiary proof. Unquestionably, courts have already begun a slow transformation into embracing direct digital evidence,[20] but incorporating the existence of other digital clues will accelerate the process of developing digitally aware evidentiary rules. This Article is the first to address the role of digital habit evidence as a secondary form of proof. As will be detailed, digital habit evidence expands the scope of those digital trails, allowing patterns of past actions to be given new relevance.

Part I of this Article lays out the traditional understanding of habit evidence that gave rise to FRE 406.[21] Upon examination, the common law roots and modern interpretation both point to an evidentiary doctrine broad in scope and almost limitless in the ways habit can be proved. While rather neutered in practice, the underlying theory and history of habit evidence suggest a radically new potential application in a digital age.

Part II of this Article applies the habit rule to the new world of the Internet of Things.[22] This Part examines emerging digital patterns in homes, on persons, around movements, and at work, which reveal admissible habits and routine practices. Cases have already emerged where digital clues are being used as direct evidence,[23] and this Part explores how the rules around habit evidence open up new avenues of discovery, litigation, and trial evidence.

Part III of this Article offers a theoretical justification for traditional habit evidence based upon modern digital proof.[24] In many ways, new data sources prove the common law instincts that birthed

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20. *See, e.g.*, Daniel R. Tilly, *Adopted Statements in the Digital Age: Hearsay Responses to Social Media "Likes,"* 93 N.D. L. REV. 277, 283 (2018); Siri Carlson, Comment, *When Is a Tweet Not an Admissible Tweet? Closing the Authentication Gap in the Federal Rules of Evidence*, 164 U. PA. L. REV. 1033, 1042 (2016); Jeffrey Bellin & Andrew Guthrie Ferguson, *Trial by Google: Judicial Notice in the Information Age*, 108 NW. U. L. REV. 1137, 1140 (2014); Jeffrey Bellin, *eHearsay*, 98 MINN. L. REV. 7, 12 (2013); Liesa L. Richter, *Don't Just Do Something!: E-hearsay, the Present Sense Impression, and the Case for Caution in the Rulemaking Process*, 61 AM. U. L. REV. 1657, 1672 (2012).

21. *See infra* Part I.

22. *See infra* Part II.

23. *See infra* Part I.A.1–2 (discussing English and U.S. cases that demonstrate a reliance on the doctrine and providing a justification for habit evidence).

24. *See infra* Part III.A.

the doctrine. In addition, this Part examines how digital habit evidence will be used in the future, both as an offensive trial tactic to introduce habit and as a defensive trial tactic to preclude habit. The reality will be that digital habit evidence could be provable in ways that have never been possible in a pre-digital age.[25] Finally, this Part examines how the expansion of digital habit evidence complicates existing rules around relevance, character evidence, and other established limiting principles.

The goal of this Article is to reimagine habit evidence for a digital era. In doing so, the Article hopes to start a conversation about how existing evidentiary rules open new trial possibilities in a world where data trails can be transformed into relevant evidence.

I. HABIT EVIDENCE

Habit evidence has long been a part of American trial practice.[26] Long before the codification of "Habit; Routine Practice" in FRE 406, courts were relying on the argument that particular human habits could be relevant evidence in criminal and civil cases. This Section proceeds in three parts, first tracing the early history of habit evidence in pre-Rules common law cases, then examining the debates around codifying FRE 406, and finally tracing the commonalities that provide for a surprisingly broad rule set perfect for an age of quantifying patterns, activities, and customary business activities.

A. Common Law Habit Evidence

The allure of habit evidence has to do with its intuitive appeal to judges and juries. Humans develop regularized habits that mark us, shape us, and become part of how we live our lives.[27] The side of the bed you sleep on with your partner, your bathroom routine at night,

25. *See infra* Part III.B.3

26. Halloran v. Va. Chems. Inc., 361 N.E.2d 991, 995 (N.Y. 1977) ("Because one who has demonstrated a consistent response under given circumstances is more likely to repeat that response when the circumstances arise again, evidence of habit has, since the days of the common-law reports, generally been admissible to prove conformity on specified occasions.").

27. Kevin S. Marshall, Kathy Luttrell Garcia & Irving Prager, *The Habit Evidence Rule and Its Misguided Judicial Legacy: A Statistical and Psychological Primer*, 36 LAW & PSYCH. REV. 1, 59 (2012) ("Researchers have found that 'much of everyday action is characterized by [habitual] repetition' and '[m]ost repeated actions are habitual.' . . . In the everyday behavior of individuals, '[r]epetition is the rule, rather than the exception.' After all, we tend to be 'creatures of habit.'" (citations omitted)).

which sock you put on first are all habits that repeat more or less consistently every day. It is for this reason that trial lawyers have long sought to turn habits into evidentiary proof. While a habit does not definitively prove the fact at issue, it offers probative evidence that a pattern of consistent behavior occurred in a case.[28] Especially in cases marked by the absence of direct proof, habit can fill the gaps through indirect inferences from past patterns to tip the scales to predict what likely happened.

1. *Early History*. Because of its appeal, habit evidence has been the subject of evidentiary battles since the late 1700s.[29] As cataloged in the influential treatises of John Henry Wigmore, trial courts routinely relied on some form of habit evidence to admit patterns of conduct.[30] For example, English and U.S. cases from the eighteenth, nineteenth, and twentieth centuries show a reliance on the doctrine involving habits for regularly paying for services,[31] habits of what individuals

28. Habit is primarily an admissibility doctrine that allows relevant evidence into trial.

29. *See infra* note 31.

30. 1 JOHN HENRY WIGMORE, A POCKET CODE OF THE RULES OF EVIDENCE IN TRIALS AT LAW 48 (1910) ("Wherever a human act or the manner of doing or not doing an act is material to be proved, the person's habit . . . is relevant, providing it involves a fair regularity or frequency of conduct as to the act or class of acts in question."); *see also* 1 JOHN HENRY WIGMORE, A TREATISE ON THE ANGLO-AMERICAN SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW INCLUDING THE STATUTES AND JUDICIAL DECISIONS OF ALL JURISDICTIONS OF THE UNITED STATES AND CANADA § 93, at 326–27 (2d ed. 1923) [hereinafter TREATISE] ("[T]he admissibility of a person's habit, usage, or custom as evidence that he did or did not do the act in question may be said to be universally conceded. Yet . . . the individual circumstances going to affect the regularity of the habit[] will from time to time effect its exclusion." (footnote omitted)).

31. TREATISE, *supra* note 30, § 93, at 326 (citing to various cases such as "England: 1795, Lucas *v.* Novosilieski, 1 Esp. 296 (to prove payment of wages, evidence was offered of the defendant's custom of paying the workmen every Saturday night, and of the plaintiff's presence waiting with the rest; admitted, 'as he worked under the same terms with the other workmen')," "1811, Evans *v.* Birch, 3 Camp. 10 (action against a milk-carrier for moneys not turned over to his employer; the regular course of business in paying over the receipts daily, admitted as showing payment)," and "1829, Sellen *v.* Norman, 4 C. & P. 81, note (course of paying wages every Saturday night, admissible)").

carried on their persons,[32] how they traveled,[33] the care they took,[34] and even whether they habitually cursed or not.[35] Wigmore's treatise cataloged the general principle that habit had probative value and was admissible at trial.[36]

Whether habit was really an accepted common law doctrine is not without debate. The Wright and Miller treatise argues that Wigmore overstated the common law acceptance of habit evidence, and, in fact, many judges were skeptical about admission.[37] While acknowledging that courts did allow habit in cases without eyewitness testimony and in cases about routine custom,[38] Wright and Miller also emphasized

32. *See id.* at 326–27 (citing to various cases such as "Carwile *v.* State, 148 Ala. 576, 39 So. 220 (deceased's habit as to carrying a billbook, admitted)," "White *v.* State, 100 Ga. 659, 28 S. E. 423 (habit of carrying a pistol with one charge only, admitted to show that it was so carried till the moment of killing, and thus that it was not fully loaded and then partly fired)," and "Oliver *v.* State, 106 Ga. 142, 32 S. E. 18 (carrying concealed weapon; habit of carrying it openly, not admitted for defendant)").

33. *See id.* at 327 (citing to various cases such as "Smith *v.* R. Co., 70 N. H. 53, 47 Atl. 290 (death at a crossing; deceased's 'uniform habit of slackening the speed of his horse' at the crossing, admitted to show 'that he did so on his fatal trip')," "Stone *v.* R. Co., 72 N. H. 206, 55 Atl. 359 (1903) (habitual speed of a particular train at a certain point, admitted)," and "Perlstein *v.* Express Co., 177 Mass. 530, 59 N. E. 194 (prescribed routes for defendant's drivers, admitted to show that the presence of one driver at a certain place was not in the course of duty)").

34. *See id.* (citing to various cases such as "Tucker *v.* B. & M. R. Co., 73 N. H. 132, 59 Atl. 943 (deceased's habit to stop and look at a crossing)" and "Lock *v.* Chicago B. & Q. R. Co., 281 Mo. 532, 219 S. W. 919 (injury by stumbling over a brakebeam between tracks in a railroad yard; the habit of defendant's employees to leave materials scattered over the yard, admitted on the issue of the location of the brakebeam)").

35. *See id.* (citing cases such as "Barr *v.* Post, 56 Nebr. 698, 77 N. W. 123, *semble* (that 'he never used profane language', admissible, to show non-user on a particular occasion)"). *But see id.* § 97, at 333–35, ("Negligence . . . is the doing of one act in a manner which amounts to negligence in that some other act is omitted which ought to have accompanied it. There is no reason why such a habit should not be used as evidential . . . .").

36. *Id.* § 92, at 325 (1923) (defining the general principle as "[o]f the probative value of a person's habit or custom, as showing the doing on a specific occasion of the act which is the subject of the habit or custom, there can be no doubt" while citing to Walker v. Barron, 6 Minn. 508, 512 (1861) to explain that customs "may, like any other facts or circumstances, be shown when their existence will increase or diminish the probabilities of an act having been done or not done, which act is the subject of contest" and State v. Railroad, 52 N.H. 528, 532 (1873) to say that "[i]t would seem to be axiomatic that a man is likely to do or not to do a thing, or to do it or not to do it in a particular way, [according] as he is in the habit of doing or not doing it").

37. CHARLES ALAN WRIGHT & ARTHUR R. MILLER, 23 FEDERAL PRACTICE & PROCEDURE EVIDENCE § 5272 (2d ed. 2022) ("Wigmore suggested that the common law made habit evidence admissible . . . . This statement is clear enough, but is probably wrong insofar as it suggests the admissibility of habit and routine practice evidence was established by the common law.").

38. As Wright and Miller explain,

that judges were wary of allowing habit evidence as it could so easily be conflated with character evidence, and the doctrine confused past acts with present questions of fact.[39] While the line between what courts should allow and what they should not under the common law doctrine was never clear, the debate demonstrates an early acceptance of the habit evidence concept.

Part of the problem with the doctrine, of course, is that defining when a human pattern becomes a settled habit is not self-evident. Trial courts long ago also recognized the risk in admitting habit evidence to prove actions consistent with just any recognizable human pattern. After all, while habits prove past acts, they do not necessarily prove facts relevant to any particular case. One day you might choose to sleep on a different side of the bed, or an injury might change an established morning routine. Fixed patterns can change for a host of external or personal reasons.

2. *Justifications for Habit Evidence*. The justification for habit evidence traditionally centered on two alternative theories—the psychological theory[40] and the probabilistic theory.[41] The psychological

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> First, a number of courts admitted evidence of the habit of a person in cases in which there was no eyewitness to the specific conduct to be proved. Second, courts were more receptive to evidence of the regular practice of a group—usually referred to by the common law as "custom"—than to evidence of an individual's habit. Even here, however, some courts held that custom could only be admitted to corroborate the testimony of a witness to the conduct in question. Finally, it was sometimes noted that courts were more willing to admit habit evidence in civil cases than in criminal prosecutions.

WRIGHT & MILLER, *supra* note 37.

39. Wright and Miller identify that,

> [T]here were three practical reasons why common law courts were reluctant to recognize the admissibility of habit evidence. First, and most importantly, it would be easy to expand the habit doctrine so as to undermine the related rule that limits the use of character evidence to prove conduct. . . . Second, since habit can only be proved by inquiry into instances of alleged habitual conduct, expanding the admissibility of habit evidence would also endanger the common law rule excluding similar fact evidence, thus leading to costly collateral inquiries into whether the instances offered to support the habit had indeed taken place. Finally, at some deeper level, many judges were undoubtedly repelled by deterministic overtones of the arguments favoring the admissibility of habit evidence.

Id.

40. WRIGHT & MILLER, *supra* note 37, § 5273 ("The narrower definition may be called the psychological definition. It uses 'habit' in the Pavlovian sense of a conditioned response to a particular stimulus that is free from a conscious exercise of volition." (footnotes omitted)).

41. *Id.* (defining "habit" under a probability theory as any repetitive conduct that "requires no psychological explanation for why the actor can be expected to follow the habit on a particular occasion other than the notion that people simply are more likely to do what they repeatedly have

theory focused on the assumption that some acts happen on an almost unconscious level, without thought, in response to particular environmental factors.[42] Responses are simply automatic and nonvolitional and thus trustworthy because there is not much differentiation each time the act is performed.[43] Key to the psychological theory of habit is the almost uncontrollable, unconscious, yet automatic response that separates habit from other forms of propensity evidence.[44]

The probabilistic theory, on the other hand, looks at the number of times an act has been repeated. If the individual responds to a stimulus in the same way over and over, the probability is that the person will have acted in the same way again.[45] Key to the probabilistic

done before rather than choose to engage in different conduct"). *See generally* Marshall et al., *supra* note 27, at 30 ("In 1964, Kenneth M. Lewan authored *The Rationale of Habit Evidence*, wherein he identified the probabilistic nature of habit evidence. According to Lewan, the rationale of habit evidence is premised on the generalization of probabilistic events." (citing Kenneth M. Lewan, *The Rationale of Habit Evidence*, 16 SYRACUSE L. REV. 39, 53 (1964))).

42. Marc D. Ginsberg, *An Evidentiary Oddity: "Careful Habit" – Does the Law of Evidence Embrace This Archaic/Modern Concept?*, 43 OHIO N.U. L. REV. 293, 299–300 (2017) ("The 'legal' or evidentiary explanation of habit is bolstered by psychology. Psychologists have explained habit as follows: 'Habits enable the performance of "our actions in a rather mindless fashion."' 'Most habitual behavior arises and proceeds efficiently, effortlessly, and unconsciously.'"); *see also* Marshall et al., *supra* note 27, at 77 (explaining that "automaticity is the essence of habit" and courts should focus on automaticity, just like researchers, because "[a]utomaticity drives the reliable nature of habit evidence because it is automaticity that signifies habit formation—that a habit has formed by the creation and strengthening of neural links between situational cues and responsive actions.").

43. Marshall et al., *supra* note 27, at 14 ("The psychological theory focuses on the non-volitional nature of habit evidence, signifying that such evidence should establish that the actor's response to specific stimuli was specific, non-volitional, and automatic or semi-automatic."); Thomas M. Mengler, *The Theory of Discretion in the Federal Rules of Evidence*, 74 IOWA L. REV. 413, 417 (1989) ("But uniformity is just one aspect of the psychological theory. The other feature is that the individual's response must be unconsciously mechanical—Pavlovian.").

44. *See* Weil v. Seltzer, 873 F.2d 1453, 1460 (D.C. Cir. 1989) ("Rule 406 allows certain evidence which would otherwise be inadmissible if it rises to the level of habit. In this context, habit refers to the type of nonvolitional activity that occurs with invariable regularity."); Simplex, Inc. v. Diversified Energy Sys., Inc., 847 F.2d 1290, 1293 (7th Cir. 1988) (requiring conduct that is "'semi-automatic' in nature" to protect against "the very real possibility that such evidence will be used to establish a party's propensity to act in conformity with its general character").

45. Marshall et al., *supra* note 27, at 15 (explaining that the probability theory emphasizes the repetitive nature of conduct because "[i]f the actor responded consistently to specific stimuli invariably (or almost invariably) on a sufficient number of occasions, this would be evidence of a habit, even if the act was the result of the actor's consciously deliberate choice to engage in the conduct"); Warren Moïse, *Rule 406: I Habit, You Don't*, S.C. LAW., Nov. 2006, at 13 ("A competing approach looks at probability. When someone acts a certain way 51 percent of the time or greater, 'the odds are' that they acted the same way on the occasion in question.").

theory is the regularity of the action, which suggests it is more likely that the actor did the same act in the same way in the present case.[46]

The problem arising from both theories was quantifying how regularized a habit needs to be before admitting it as evidence. How many times does an act need to occur before we consider it a habit? How automatic must it be? How predictable? As Wigmore recognized, identifying this regularity was key to legitimizing the doctrine.[47]

> There is, however, much room for difference of opinion in concrete cases, owing chiefly to the indefiniteness of the notion of habit or custom. If we conceive it as involving an invariable regularity of action, there can be no doubt that this fixed sequence of acts tends strongly to show the occurrence of a given instance. But in the ordinary affairs of life a habit or custom seldom has such an invariable regularity. Hence, it is easy to see why in a given instance something that may be loosely called habit or custom should be rejected, because it may not in fact have sufficient regularity to make it probable that it would be carried out in every instance or in most instances. Whether or not such sufficient regularity exists must depend largely on the circumstances of each case.[48]

A "circumstances of each case" standard, of course, places great reliance and much deference in the hands of trial judges and creates inconsistency in practice.

3. *Overlap with Character Evidence.* Another concern about habit evidence was how the concept overlapped with "character evidence" generally disallowed in court.[49] Trials are supposed to be about the facts, not substituted moral judgments about the character of the litigants.[50] Character evidence was thus disfavored because personal

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46. Levin v. United States, 338 F.2d 265, 271 (D.C. Cir. 1964) (using the words "invariable regularity" to describe habit, a term cited in the Advisory Committee Notes of FRE 406).

47. TREATISE, *supra* note 30, § 92, at 325–26.

48. *Id.*

49. FED. R. EVID. 404(a) (providing that, with certain exceptions, "[e]vidence of a person's character or character trait is not admissible to prove that on a particular occasion the person acted in accordance with the character or trait").

50. United States v. Linares, 367 F.3d 941, 945 (D.C. Cir. 2004) ("[A] concomitant of the presumption of innocence is that a defendant must be tried for what he did, not for who he is." (quoting United States v. Daniels, 770 F.2d 1111, 1116 (D.C. Cir. 1985))); *see also* Paul F. Rothstein, *Intellectual Coherence in an Evidence Code*, 28 LOY. L.A. L. REV. 1259, 1265 (1995) ("Habit is earmarked by relative—not necessarily complete—invariability and involuntariness. It is not necessarily morally tinged, as is character.").

feelings about good or bad character can distract fact-finders from the actual evidence or testimony.[51] But, as one might imagine, the line between a general sense of one's character (being careful, kind, drunk) can easily overlap with a habit of stopping at every stop sign, always saying thank you, regularly drinking a particular type of liquor.[52] Habits that signify a particular character get close to a line that the common law tried to keep distinct.[53] As observed in a Treatise published in 1899:

> A habit of doing a thing is naturally of probative value as indicating that on a particular occasion the thing was done as usual, and, if clearly shown as a definite course of action, is constantly admitted in evidence. Nevertheless, there are some instances in which habit may be thought to be obnoxious to the character rule, particularly a habit of intoxication or intemperance, and a habit of carelessness or negligence; and on these points there is no uniformity of ruling.[54]

This line drawing between character evidence and habit evidence has remained fuzzy to the present day.[55]

Finally, in pre-Rules cases, habit could be introduced to prove identity. More precisely, courts have ruled that a particular habit was

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51. Daniel J. Capra & Liesa L. Richter, *Character Assassination: Amending Federal Rule of Evidence 404(b) To Protect Criminal Defendants*, 118 COLUM. L. REV. 769, 771 (2018) ("The prohibition on character evidence is a time-honored tenet of evidence law. The American adversary system was designed to convict defendants based upon their conduct and not based on their general character or past misdeeds.").

52. *See, e.g.*, 29 AM. JUR. 2D *Evidence* § 384 (2010) ("Habit evidence is considered superior to character evidence because the uniformity of an individual's response to habit is far greater than the consistency with which his or her conduct conforms to character or disposition.").

53. *See, e.g.*, Reyes v. Mo. Pac. R.R. Co., 589 F.2d 791, 794 (5th Cir. 1979) (deciding a case involving a negligence suit against a train company after the plaintiff fell asleep on the tracks and denying prior intoxication convictions from being introduced as habit evidence to suggest the plaintiff was intoxicated at the time of the incident by noting "[p]erhaps the chief difficulty in deciding questions of admissibility under Rule 406 arises in trying to draw the line between inadmissible character evidence and admissible habit evidence"); Charmley v. Lewis, 729 P.2d 567, 572 (Or. 1986) (detailing the difference between character and habit evidence).

54. 1 SIMON GREENLEAF, A TREATISE ON THE LAW OF EVIDENCE § 14j, at 53–54 (John Henry Wigmore ed., 16th ed. 1899) (footnotes omitted) (citations omitted).

55. *Compare* TREATISE, *supra* note 30, § 92, at 325–26 (stating that "[t]he idea of habit is sometimes difficult to distinguish from that of *Character*"), *with* Loussier v. Universal Music Grp., Inc., No. 02CV2447KMW, 2005 WL 5644420, at *2 (S.D.N.Y. Aug. 30, 2005) (explaining that "courts have been cautious in allowing evidence that attempts to prove a pattern of conduct as habit, because of the risk that such evidence will be used to establish a party's propensity to act in conformity with his general character, which is specifically prohibited by Fed. R. Evid 404" because "[d]ifficulty arises in drawing the line between inadmissible character evidence and admissible habit evidence" (footnotes omitted) (citations omitted)).

so distinctive it revealed the person's identity[56] or that certain patterns were so predicable they identified a person's location.[57] Patterns of behavior could, thus, reveal the person described.

4. *Routine Practices of Organizations and Businesses*. Organizations also develop habits. In the common law, personal habits had a corollary in the habits of businesses and organizations. Like people, businesses develop routine practices that can be relied upon as regular and predictable.[58] The common law's expression of this principle of "habits in the course of business" was seen through the idea of "custom." As Wigmore explained:

> In evidencing a custom or usage (*i.e.* the habit of a body of persons) by specific instances, the same general principle as before is applicable; that is, the instances offered *(a)* should be sufficiently numerous to indicate a fairly regular course of business, and *(b)* should occur under conditions substantially similar to that in question.[59]

As with personal habit, the requirements of regularity and repetition apply to custom.[60] For example, custom in business included how

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56. *See* 1 FRANCIS WHARTON, A TREATISE ON THE LAW OF EVIDENCE IN ISSUES 694–95 (8th ed. 1880) ("Habits of individuals may come up for comparison in issues of identity . . . . But questions of identity are an exception to the general rule, which is, that evidence of habit is inadmissible for the purpose of showing that a particular person did or did not do a particular thing." (footnote omitted)).

57. 7 AM. JUR. 3D *Proof of Facts* § 8 (1990) ("Habit evidence may also be received to prove location. That is, [it] may be important because it tends to establish where a person probably was at the time of the accident, a fact that may be hardest to determine with respect to pedestrians struck by automobiles.").

58. Fritchie v. Alumax Inc., 931 F. Supp. 662, 676 (D. Neb. 1996) ("[R]outine business practices are often relied upon by other businesses and because routine business practices are derived from concerted planning activities driven by economic concerns about efficiency which are of necessity more regimented than individual conduct." (citing 2 Jack Weinstein & Margaret Berger, *Weinstein's Evidence* ¶ 406[03] at 406–17 (1992))).

59. *See* TREATISE, *supra* note 30, § 379, at 690, 700–01 (explaining further that under (a) "no difficulty seems to arise; the discretion of the trial Court should control," but under (b) "there is much opportunity for difference of opinion in given cases. The precedents illustrate all sorts of trades and usages, and no detailed generalization seems feasible" (footnote omitted)).

60. Walker v. Barron, 6 Minn. 508, 512 (1861) (explaining customs "like any other facts or circumstances, [may] be shown when their existence will increase or diminish the probabilities of an act having been done or not done, which act is the subject of contest" but that "[a] custom, however, must be so well established in the particular locality, trade, profession or business, to permit its being proved, that all men transacting the business to which it relates, must be presumed to have knowledge of it, and to act and contract with reference to it").

commercial entities preserved their books or cataloged receiving goods and services.[61] This tradition of business custom evidence ran right through the time when the Federal Rules came into existence.[62]

5. *Methods of Proving Habit Evidence*. Not only was the scope and scale of habit and custom evidence broad and relatively permissive, so was the manner in which common law courts allowed for proof of that habit. Courts regularly allowed testimonial[63] and direct evidence of habit,[64] and Wigmore thought circumstantial evidence of habit should also be admissible if proved with sufficient instances of repeated conduct:

> In general, where a habit of conduct is to be evidenced by specific instances, there is no reason why they should not be resorted to for that purpose. The only conditions *are (a)* that they should be numerous enough to base an inference of systematic conduct, and *(b)* that they should have occurred under substantially similar circumstances, so as to be naturally accountable . . . by a system only, and not as casual recurrences.[65]

In practice, the only procedural limitations on proving habit were a "no eyewitnesses rule," which disallowed reliance on habit if there were eyewitnesses available to testify instead, and an occasional

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61. TREATISE, *supra* note 30, § 93 n.1, at 326–27 (citing to various cases such as "Foltz *v.* State, 33 Ind. 215 (business habits, admitted to evidence the selling of cigars)," "Riordan *v.* Guggerty, 74 Ia. 693, 39 N. W. 107 (the destruction of a telegram-original, evidenced by a custom of the office to destroy all such papers after six months)," and "Vaughan *v.* R. Co., 63 N. C. 11 (whether goods had been received by a rail road company; its habit to weigh and mark goods when received, admitted, as showing that they would have been found marked)").

62. *See, e.g.*, United States v. Delgado, 459 F.2d 471, 472 (2d Cir. 1972) (allowing the routine practice of a business requiring delivery men to accept no checks in payment for goods unless either the customer or the employee wrote the former's name on the reverse of the check as evidence); Dothard v. Cook, 333 So. 2d 576, 579 (Ala. 1976) ("Custom has been defined by the American Law Institute's Code of Evidence as 'a means of behavior of a group of persons regularly repeated in like circumstances.' As such, evidence of custom has long been admissible in the courts." (citations omitted)).

63. TREATISE, *supra* note 30, at 690 ("§ 375. . . . Evidence of Habit or Custom may of course be furnished testimonially, by a witness who asserts its existence in the form: 'A has a habit of riding to the city'; 'There is a custom of granting a discount.'").

64. GREENLEAF, *supra* note 54, § 14n, at 59–60 ("Evidence to prove Habit, Custom. []A habit or custom is usually evidenced by direct testimony to its existence. But it may also be evidenced by distinct and repeated acts; the conditions being that they should be sufficiently numerous, and should have occurred under fairly similar circumstances.").

65. TREATISE, *supra* note 30, at 691 (citation omitted).

corroboration requirement.[66] These limits were inconsistently applied in practice.

In large measure because admissibility standards were lax in practice, trial courts did what they wanted.[67] The concept of habit evidence, thus, while firmly part of the common law of evidence, was only an irregular and inconsistent part of trial practice. Nevertheless, it was established enough to be considered for codification in the proposals for the Federal Rules of Evidence.[68]

B. Habit & the Federal Rules of Evidence

Habit evidence's inconsistent common law history raised several hard questions for the drafters of the Federal Rules of Evidence. First, how should habit be defined? Should the drafters craft a narrow rule so that judges could distinguish it from character evidence and apply it consistently to people and institutions in trial? Second, what was the underlying theory that justified reliance on habit evidence? Was it a psychological theory about automatic human behavior or a probabilistic theory about repetitive action and predictability?[69] Third, should traditional common law limitations requiring corroboration and only allowing habit evidence when there were not eyewitnesses be codified through rules?

The drafters of FRE 406 resolved these three questions, although not necessarily in explicit terms. FRE 406 "Habit; Routine Practice" reads:

> Evidence of a person's habit or an organization's routine practice may be admitted to prove that on a particular occasion the person or organization acted in accordance with the habit or routine practice. The court may admit this evidence regardless of whether it is corroborated or whether there was an eyewitness.[70]

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66. *Id.* at 351.

67. *Id.* at 690 ("In evidencing the *Habit of an individual,* it is impossible to group the precedents with entire exactness, because a Court occasionally excludes the evidence without making it clear whether its objection is to Habit as itself irrelevant to something else, or merely to the evidence of Habit.").

68. Congress codified the Federal Rules of Evidence in 1973. *See infra* Part I.B (discussing the codification of habit evidence).

69. Marshall et al., *supra* note 27, at 14 ("Two divergent theories underlie the habit rule (as adopted by Rule 406 and state authorities): the psychological theory and the probabilistic theory.").

70. FED. R. EVID. 406.

By studying the language chosen in the Rule, one can easily see that the drafters chose not to provide an explicit or limiting definition of habit, accepted the validity of both the psychological and probabilistic theories of reliability, and rejected all common law admissibility restrictions. As will be explained, these choices (or nonchoices) created a strikingly open and broad rule for admissibility of certain patterns of human behavior.[71]

First, FRE 406 provides no set definition of habit evidence, allowing judges to recognize habit as admissible without many limits.[72] Whereas much of the Federal Rules of Evidence involves rules of exclusion through definitions, FRE 406 opens up avenues for admissibility.[73] By not defining habit, the drafters intended to free trial courts to act within their broad discretion.[74] As Professor Thomas Mengler discovered in his research on the Advisory Committee debates, the drafters affirmatively resisted demands for more specificity, choosing to leave the term habit undefined.[75]

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71. It also seems to suggest that even though Wigmore may have overstated the acceptance of habit evidence in the common law, his was a preferred interpretation by the drafters of the Advisory Committee Note.

> The Advisory Committee's Note seems calculated to disguise rather than reveal the intent of the drafters. It states that: "The rule is consistent with prevailing views." Given the confused state of the common law and the elusiveness of the word "consistent," the statement could not be said to be entirely false or entirely true. As we have seen, it was the "prevailing" view among scholars and the prior codifiers that habit evidence ought to be more freely admitted and that the corroboration and "no-eyewitness" restrictions should be repealed. Wigmore is the only person who thought that the courts already had adopted this view. The Note seems to borrow the technique used by Wigmore and the prior codifiers to explain away the majority approach by suggesting that the courts simply did not understand the true meaning of "habit" and, thus, confused it with something else.

See WRIGHT & MILLER, *supra* note 37 (footnotes omitted).

72. Edward J. Imwinkelried, *Using the Evidence Course as a Vehicle for Teaching Legisprudential Skills*, 21 QUINNIPIAC L. REV. 907, 922 (2003) ("Rule 406 deals with the admissibility of habit evidence. Unfortunately, the text of the rule does not set out a definition of 'habit.'" (footnote omitted)).

73. WRIGHT & MILLER, *supra* note 37 ("Rule 406 is an invitation to courts to innovate, cautiously perhaps, but free of the dead hand of precedent or the rigor of a statute." (footnote omitted)).

74. *See* Glen Weissenberger, *Evidence Myopia: The Failure To See the Federal Rules of Evidence as a Codification of the Common Law*, 40 WM. & MARY L. REV. 1539, 1585 (1999) ("Without a clear definition in the rule, any court applying Rule 406 would recognize immediately that it must make a choice as to a definition.").

75. Thomas M. Mengler, *supra* note 43, at 416 ("Professor Cleary responded to complaints that Rule 406 should contain a definition of habit. He wrote tersely: 'After wrestling with the definitional problem, the Advisory Committee finally decided to leave the term "habit" undefined.'"). *But see* CHARLES ALAN WRIGHT & KENNETH W. GRAHAM, JR., 23 FEDERAL

Second, the drafters accepted the principles behind both the psychological theory of habit and the probabilistic theory of habit,[76] citing to cases in the Advisory Committee Notes that provide examples of both. For example, the Advisory Committee Rules cited approvingly to *Whittemore v. Lockheed Aircraft Corp*.[77] as an appropriate use of habit evidence based on a probabilistic theory.[78]

Whittemore is a strange case to cite in support of a probabilistic theory of habit. *Whittemore* involved the crash of a new airplane on its maiden flight to its new owners Northwest Air Lines.[79] Fred Whittemore was the operations manager for Northwest Air and also a licensed and experienced pilot. He and another pilot were going to fly the plane and deliver it to the Northwest Air fleet. When the plane crashed, killing everyone aboard, Whittemore's wife sued Lockheed, the plane's maker, for negligence for failing to protect a passenger. Lockheed countered that Whittemore was not a passenger but was piloting the plane and thus was not someone to whom they owed the same duty of care, and, as the pilot, Whittemore could be faulted for contributory negligence because crashing the plane caused the death. Whittemore's widow asserted that the other pilot was flying the doomed plane. The evidentiary question turned on what proof could be adduced about who was actually flying the plane—Whittemore or the other pilot? One proffered line of argument was habit evidence, namely, Whittemore's habit of four times previously flying new Lockheed planes to Las Vegas to join the Northwest Air fleet. The California appellate court found this pattern of four times sufficient to constitute admissible habit evidence to show that Whittemore was the pilot.[80]

PRACTICE AND PROCEDURE § 5273 (2022) ("[T]here is reason to believe that the failure to define 'habit' was the result of the Committee's conscious decision to avoid favoring one of the two traditional definitions over the other.").

76. Imwinkelried, *supra* note 72 ("At common law, two, competing definitions emerged. . . . The rub is that the Advisory Committee Note to Rule 406 mentions both definitions without voicing a preference for one or the other." (footnote omitted)); Mengler, *supra* note 43, at 415 ("Rule 406 contains two analytically distinct definitions of habit, one quite restrictive, the other more liberal. That flexibility most likely was not inadvertent.").

77. Whittemore v. Lockheed Aircraft Corp., 151 P.2d 670 (Cal. 1944).

78. *See* FED. R. EVID. 406 advisory committee's note (citing *Whittemore*, which upholds "the admission of evidence that plaintiff's intestate had on four other occasions flown planes from defendant's factory for delivery to his employer airline, offered to prove that he was piloting rather than a guest on a plane which crashed and killed all on board while en route for delivery").

79. *Whittemore*, 151 P.2d at 671.

80. *Id.* at 678.

Scholars have characterized this rather limited numerical probability as an example of the Advisory Rule's adoption of the probabilistic theory.[81] Clearly, flying a plane is volitional and neither automatic nor unthinking. The only justification for highlighting *Whittemore* as one of the few cases cited approvingly in the Advisory Committee notes is to show that the probabilistic theory has been in part adopted by the Rules (or at least not excluded by the Rules). While four is not a high number of prior flights, the probability that Whittemore flew the plane like he had four times before was sufficient to demonstrate an admissible habit.

The second case cited approvingly by the drafters was *Levin v. United States*,[82] a case in which the appellate court denied the introduction of a religious habit of remaining at home on the Sabbath. Specifically, the court refused to allow evidence that the defendant did not work on the Sabbath in a case where the defendant wished to use the fact as a defense to why he could not have been taking a bribe during that time.[83] The court stated, "It seems apparent to us that an individual's religious practices would not be the type of activities [that] would lend themselves to the characterization of 'invariable regularity.' Certainly the very volitional basis of the activity raises serious questions as to its invariable nature, and hence its probative value."[84] In so denying the admissibility of a regular, weekly habit that could be demonstrated by several witnesses, the court seemed to reject a pure probabilistic theory. After all, it is probable that most Friday nights Levin was home on the Sabbath, even if not on the night of the alleged bribery incident. The court, and the drafters of the Federal Rules, appeared to require a more automatic, psychological form of habit that was not so volitional.

As Mengler concluded after studying the citation choices made by the Advisory Committee, by allowing for the introduction of both psychological-based evidence and probabilistic-based evidence, FRE 406 creates real flexibility for the trial court:

> [T]he Advisory Committee placed in the Note two contrasting theories of habit so that trial courts legitimately either could exclude or admit certain kinds of evidence which arguably could be labeled

81. *See supra* notes 69, 76 and accompanying text.

82. Levin v. United States, 338 F.2d 265 (D.C. Cir. 1964); *see* FED. R. EVID. 406 advisory committee's note (citing *Levin*, 338 F.2d 265).

83. *Id.* at 270.

84. *Id.* at 272.

> habit. The drafters, in effect, provided flexibility within the parameters of the Rule itself. For example, presented with evidence that a litigant regularly reads mystery novels before going to bed to prove the litigant was doing so on the night in question, a trial court either could exclude it under the psychological theory, since reading is volitional, or admit it under the probability theory, since the litigant's behavior was specific and sufficiently regular.[85]

Rule 406 is typically interpreted in a broad and quite flexible manner, allowing both types of traditional common law habit evidence.[86]

Third, FRE 406 removed any common law limitations about corroboration or eyewitnesses. If there were any debate about whether common law restrictions should apply, FRE 406 makes clear, "The court may admit this evidence regardless of whether it is corroborated or whether there was an eyewitness."[87] This language was an explicit response to the question of whether there should be further admissibility restrictions.[88]

As a final point of clarity, the Advisory Committee drafters provided guidance about the line between impermissible character evidence and admissible habit evidence. Echoing common law insights, issues of specificity, regularity, and the automatic nature of the response are all evident.[89] Quoting *McCormick on Evidence*, the Advisory Committee explained:

> "Character and habit are close akin. Character is a generalized description of one's disposition, or of one's disposition in respect to a general trait, such as honesty, temperance, or peacefulness. 'Habit,' in modern usage, both lay and psychological, is more specific. It

85. Mengler, *supra* note 43, at 424.

86. *Id.* ("Any narrowing or defining by the appellate courts that would be binding on the trial courts necessarily would be inconsistent with the Rule's intent to provide the trial court with flexibility.").

87. FED. R. EVID. 406.

88. Paul R. Rice, *Advisory Committee on the Federal Rules of Evidence: Tending to the Past and Pretending for the Future?*, 53 HASTINGS L.J. 817, 830 (2002) ("[W]hen the Advisory Committee wanted to reject the common-law limitations on habit evidence—that there be corroboration and no eyewitnesses—Rule 406 explicitly rejected them with the clause 'whether corroborated or not and regardless of the presence of eyewitnesses.'").

89. *See* Simplex, Inc. v. Diversified Energy Sys., Inc., 847 F.2d 1290, 1293 (7th Cir. 1988) (noting caution to admit evidence under FRE 406 "because it necessarily engenders the very real possibility that such evidence will be used to establish a party's propensity to act in conformity with its general character, thereby thwarting Rule 404's prohibition against the use of character evidence except for narrowly prescribed purposes").

> describes one's regular response to a repeated specific situation. If we speak of character for care, we think of the person's tendency to act prudently in all the varying situations of life, in business, family life, in handling automobiles and in walking across the street. A habit, on the other hand, is the person's regular practice of meeting a particular kind of situation with a specific type of conduct, such as the habit of going down a particular stairway two stairs at a time, or of giving the hand-signal for a left turn, or of alighting from railway cars while they are moving. The doing of the habitual acts may become semi-automatic." Equivalent behavior on the part of a group is designated "routine practice of an organization" in the rule.[90]

A closer inspection of this passage leaves more questions than answers. Many daily patterns do involve almost automatic reactions. For example, many people use an automobile's turn signal without thinking consciously about the action. Yet, the pattern of "alighting from railway cars while they are moving" seems like an odd and fairly volitional, nonautomatic response. Further, there is some inconsistency between the *Whittemore* case, which allowed habit after only four times of a rather unusual and completely volitional decision to fly a new plane, and *Levin*, which disallowed habit after more numerous examples because not working on the Sabbath was volitional.

Inconsistency and flexibility, however, was likely the point. Granting trial judges discretion to admit or reject habit when necessary is consistent with the other discretionary powers we give to judges. Even though it had only happened four times before, the fact that Whittemore had piloted the plane in the same situation every other time does lead to a greater probability that he would have done it again. With other corroborating evidence—there were witnesses who placed Whittemore in the pilot's seat before take-off, and there was evidence of an airline custom that the person on a particular side of the plane was the pilot—the decision to admit Whittemore's habit makes some sense.[91] At the same time, Levin's wish to avoid criminal liability because of a well-established religious practice seems less convincing, if only because the habit evidence could be so easily manipulated. Although religious practices might, in fact, be more predictable and

90. FED. R. EVID. 406 advisory committee's note (quoting MCCORMICK, *supra* note 16).

91. It is important to note that habit evidence is used here to corroborate direct evidence. As Part III discusses, habit evidence can be introduced in addition to direct evidence without significant limitation.

regular in absolute numbers, their use as a quasi-alibi might be reasonably disfavored by the courts.[92]

The Federal Rules also created a parallel habit rule for customs and routine practices of businesses.[93] With equally wide scope, the rules allow for a company to adduce evidence that it responds to similar situations in the same way time and again.[94] All the calling party must do is lay the foundation that the same action occurs after the same type of stimulus.[95] As the U.S. Court of Appeals for the Sixth Circuit summarized the rule for routine practices:

> Conduct that is admissible under this rule generally satisfies the following three elements: (1) it should be of such a nature that it is unlikely that the individual instance can be recalled or the person who performed it can be located, (2) it must be specific conduct that is engaged in frequently by the group, and (3) the number of instances of such behavior must be large enough that doubt about a single instance does not destroy the inference that the practice existed. In practice, to establish that a particular conduct qualifies as a routine practice, the proponent must show that the organization had a uniform response over an adequate number of instances.[96]

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92. Marshall et al., *supra* note 27, at 16 (noting inconsistency in the cases cited by the Advisory Committee because in *Whittemore* "the evidence offered as habit was held to be admissible even though the evidence derived from an obviously volitional act (piloting an airplane) that was repeated only four times" whereas in *Levin* the appellate court upheld the exclusion of evidence offered as habit because the "'volitional basis of the activity raise[d] serious questions as to its invariable nature,' even though the behavior was arguably repeated hundreds of times").

93. Guidance Endodontics, LLC v. Dentsply Int'l, Inc., 705 F. Supp. 2d 1265, 1269 (D.N.M. 2010) ("A routine practice is the rough analog of a 'habit' in the context of an organization. '[A] "routine practice" must be "reasonably regular and uniform."'" (citations omitted)).

94. Smith v. United States, 583 A.2d 975, 980 (D.C. 1990) ("In the context of Rule 406, the practice of an organization is behavior on the part of a group which is equivalent to habit of a person, that is, an organization's practice of responding to a particular kind of situation with a particular kind of conduct.").

95. Burris v. Lerner, 745 N.E.2d 466, 473 (Ohio Ct. App. 2000) ("To lay the proper foundation, the proponent of the evidence must show that routine in fact exists and that the stimulus for the habitual response occurred on the particular occasion." (citations omitted)).

96. Martin v. Thrifty Rent A Car, 145 F.3d 1332, 1998 WL 211786, at *4 (6th Cir. 1998) (unpublished table decision) (stating the routine practices rule "reflects the concern 'that in a large organization it is unlikely that any individual will remember one of a large number of repeated transactions, and even if he does, the cost of finding that person and producing him in court is disproportionate to the value of his testimony'" (quoting 23 CHARLES ALAN WRIGHT & KENNETH W. GRAHAM, FEDERAL PRACTICE AND PROCEDURE § 5274, at 45 (1980))).

As with personal habits, the reliability comes from the specificity, regularity, and routine nature of the practices. Such repetitive acts, patterns, and processes are a common part of many businesses.

In practice, FRE 406 controls discussion of habit evidence in federal courts and has influenced many state courts.[97] Treatise writers, courts, and formal rules all agree that FRE 406 allows for habit evidence. As Professor David Kaye writes in *McCormick on Evidence*, "many jurisdictions accept the proposition that evidence of habit is admissible to show an act. These courts only reject the evidence categorically if the putative habit is not sufficiently regular or uniform, or if the circumstances are not sufficiently similar to outweigh the dangers of prejudice, distraction, and time-consumption."[98]

To summarize, five principles can be distilled from current understandings of FRE 406 that directly apply to a world of quantifiable data trails through the Internet of Things. First, under the common law and FRE 406, the lack of any limiting definition means habit evidence has a potentially incredibly broad scope. If a litigant can demonstrate something the trial court will deem an identifiable habit, the actions are potentially relevant under the rule.[99] Unlike many of the Federal Rules that seek to exclude evidence, habit remains broadly

97. States have adopted versions of the Federal Rules of Evidence. Some states have adopted formal rules or statutes, and some follow common law rules. *See* Burchett v. Commonwealth, 98 S.W.3d 492, 506–07 (Ky. 2003) (collecting state rules). Kentucky initially rejected habit evidence. *Compare* Burchett v. Commonwealth, 98 S.W.3d 492, 496 (Ky. 2003) ("Most states have adopted a version of FRE 406, either by rule or by statute. Kentucky is one of the few jurisdictions in the United States that does not currently admit such evidence."), *and* Thomas v. Greenview Hosp., Inc., 127 S.W.3d 663, 670 (Ky. Ct. App. 2004), *overruled by* Lanham v. Commonwealth, 171 S.W.3d 14 (Ky. 2005) ("Kentucky is the only jurisdiction that precludes, under all circumstances, admission of evidence of individual habit *or of the routine practice of an organization* as circumstantial evidence of conforming conduct on a specific occasion." (citations omitted)), *with* Curry v. Bennett, 301 S.W.3d 502, 504 (Ky. Ct. App. 2009) (allowing habit evidence).

98. KENNETH S. BROUN, GEORGE E. DIX, EDWARD J. IMWINKELRIED, D.H. KAYE, ROBERT P. MOSTELLER, E.F. ROBERTS & ELEANOR SWIFT, MCCORMICK ON EVIDENCE § 195, at 418 (7th ed. 2014).

99. Marshall et al., *supra* note 27, at 9 (explaining habit evidence is "[e]vidence that a person has engaged in a 'regular practice of responding to a particular kind of situation with a specific type of conduct' offered to prove that the person may have consequently acted in the same way in the same kind of situation on a specific occasion" and is typically admissible); Andrew E. Taslitz, *Myself Alone: Individualizing Justice Through Psychological Character Evidence*, 52 MD. L. REV. 1, 108 (1993) ("Habit evidence is admissible to prove that a person's conduct was in conformity with the habit displayed on a particular occasion.").

applicable to many cases.[100] This broad scope also applies to the admissibility of routine practices of businesses[101] and commercial practices.[102]

Second, almost no admissibility restrictions exist. A litigant can prove habit directly or circumstantially, often through the testimony of experts or others. Habit evidence need not be corroborated and can be admissible even when better evidence, like eyewitness evidence, is available.[103] As Part III discusses, this means that habit evidence can be introduced in addition to direct proof of the same fact. This permissiveness opens the door for many forms of indirect habit and routine practices, including digital proof.[104]

Third, both the probabilistic and psychological basis of habit are equally permissible. So admissible habit evidence could take the form

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100. For example, rules such as hearsay are rules of exclusion, attempting to limit the information before the jury. In contrast, habit evidence is a rule designed to include information about individuals. Perrin v. Anderson, 784 F.2d 1040, 1046 (10th Cir. 1986) (allowing proof of a "habit" in a case of an individual "reacting violently to uniformed police officers").

101. *See, e.g.*, *In re* Estate of Loftus, 920 N.W.2d 718, 724–25 (Neb. Ct. App. 2018) (allowing evidence of a "routine practice of signing documents for bank customers"); York Int'l Corp. v. Liberty Mut. Ins. Co., 140 F. Supp. 3d 357, 362 (M.D. Pa. 2015) (finding routine practice in the "regular practice to issue [Liberty Mutual] insurance policies to the address for the insured listed on the declarations pages of the policies"); Mobil Expl. & Producing U.S., Inc. v. Cajun Constr. Servs., Inc., 45 F.3d 96, 100 (5th Cir. 1995) (suggesting approval of routine practice evidence of how a truck company loaded its trucks in the same manner and to the same level each time).

102. *See, e.g.*, Martin v. Thrifty Rent A Car, 145 F.3d 1332, 1998 WL 211786, at *2 (6th Cir. 1998) (unpublished table decision) (allowing evidence that Thrifty Rent A Car provided a rental agreement as a routine practice); Fed. Kemper Life Assurance Co. v. Ellis, 28 F.3d 1033, 1040 (10th Cir. 1994) ("Kemper provided materials establishing a standard operating procedure regarding the sending of premium due notices."); Rosenburg v. Lincoln Am. Life Ins. Co., 883 F.2d 1328, 1336 (7th Cir. 1989) (allowing evidence showing it was the routine practice of insurance agents to give oral assurances that varied from the written insurance policy to establish that such conduct transpired in a particular instance); *In re* Swine Flu Immunization Products Liab. Litig., 533 F. Supp. 567, 574 (D. Colo. 1980) (finding that a health department's "routine practice of obtaining signed consent forms prior to administering the vaccine" established that it "acted in conformity with the habit and custom in advising [plaintiff] of the potential adverse effects of the swine flu vaccine"); Envirex, Inc. v. Ecological Recovery Assocs., Inc., 454 F. Supp. 1329, 1333 (M.D. Pa. 1978), *aff'd,* 601 F.2d 574 (3d Cir. 1979) (noting the routine business practice of sending "a complete proposal, including page 18 to all general contractors with which it contracted").

103. FED. R. EVID 406 advisory committee's note (explaining that "[a] considerable body of authority has required that evidence of the routine practice of an organization be corroborated as a condition precedent to its admission in evidence" and that this requirement is "specifically rejected by the rule on the ground that it relates to the sufficiency of the evidence rather than admissibility").

104. 2 JACK B. WEINSTEIN, WEINSTEIN'S EVIDENCE § 406[03], at 406–19 (1993) ("Proof of custom may . . . be utilized even when the person who engaged in the routine practices is unavailable to testify.").

of a pattern of action in the face of a similar triggering event or a semiautomatic reaction to an event. The stated examples in FRE 406 are both open-ended and rather lenient; indeed, if four times equals a probabilistic pattern, the bar is rather low.[105] That said, modern courts have emphasized that habit should be based on an adequate sampling of prior instances of regularized response.[106]

Fourth, the limiting factors of habit being "specificity,"[107] "regularity,"[108] and its "semiautomatic"[109] nature, while important, appear to be flexible in practice.[110] These factors may be more useful to distinguish habit from character than to cabin any understanding of habit.[111]

Finally, while there are only a few reported cases of identity and location, identity still can be proved by habit evidence.[112] As will be obvious, in the context of digital trails, habitual activity and patterns of movement can identify who a person is and where they live or work.

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105. *See supra* notes 80–81 (discussing *Whittemore*).

106. United States v. Newman, 982 F.2d 665, 668 (1st Cir. 1992) ("Although there are no 'precise standards' for determining whether a behavior pattern has matured into a habit, two factors are considered controlling as a rule: 'adequacy of sampling and uniformity of response.'" (quoting FED. R. EVID. 406 advisory committee's note)); Wilson v. Volkswagen of Am., Inc., 561 F.2d 494, 511 (4th Cir. 1977) (explaining habit evidence is only admissible "when the examples offered to establish such pattern of conduct or habit are 'numerous enough to base an inference of systematic conduct' and to establish 'one's regular response to a repeated specific situation'" or "where they are 'sufficiently regular or the circumstances sufficiently similar to outweigh the danger, if any, of prejudice and confusion'" (footnotes omitted)).

107. Marshall et al., *supra* note 27, at 9–10 ("The greater specificity of habit evidence increases its predictive value, thereby increasing the jury's ability to assess the weight of this evidence and supporting its admissibility.").

108. Mengler, *supra* note 43 ("Regularity in responding to a specific situation is a requirement not only of the probability theory, but also of the psychological theory. In order for a response to be considered semiautomatic, it must uniformly follow a stimulus.").

109. *See* FED. R. EVID. 406 advisory committee's note ("A habit . . . is the person's regular practice of meeting a particular kind of situation with a specific type of conduct . . . . The doing of the habitual acts may become semi-automatic."); 29 AM. JUR. 2D *Evidence* § 397 (2010) (stating "habit" requires "an essentially mechanical course of action").

110. WRIGHT & MILLER, *supra* note 37, § 5276 Methods of Proof ("Evidence of specific instances of conduct is the most commonly used method to prove habit or routine practice. Conduct is probative of habit or routine practice if it is particular, frequent and uniform.").

111. Marshall et al., *supra* note 27, at 10 ("The most salient difference between evidence of character and of habit is the automatic nature of habits.").

112. 7 AM. JUR. 3D *Proof of Facts* § 8 (1990) (explaining that habit evidence may be used to prove identity because "it shows whose conduct probably caused the accident, whose conduct probably caused the condition to exist, or whose responsibility it was to perform an act which was not performed; or it may show who probably was driving the vehicle or operating the instrumentality involved").

C. Conclusion on Modern Habit Evidence

Despite the agreement in theory, the application of habit and routine practices has never been clear in court decisions. It is a rule that largely exists to fill in gaps when direct evidence is unavailable, and so while it makes appearances throughout civil and criminal litigation, it does so in an irregular manner. Yet, because all humans have habits and because they tend to suggest helpful inferences about the people in the litigation, lawyers have looked for creative ways to insert habit into evidence.

While a full accounting is beyond the scope of this Article, habit evidence has been allowed in federal and state cases attempting to prove routine acts like locking one's car door,[113] or hailing a particular taxicab service,[114] or acts of intoxication,[115] or even regular possession of certain objects.[116] In medical lawsuits, habit has been allowed to prove doctors',[117] nurses',[118] and dentists'[119] routine practices of care. In

113. *In re* Charles G., 156 Cal. Rptr. 832, 834 (Ct. App. 1979) (allowing testimony that a burglary victim always locks his car as admissible habit evidence).

114. Jacobs v. Yellow Cab Affiliation, Inc., 73 N.E.3d 1220, 1254 (Ill. App. Ct. 1st Dist. 2017) (allowing testimony that a preference for a certain type of taxicab was a habit: "[Witness] testified that for approximately 15 years he always took Yellow cabs when he hailed one on the street or at a cabstand because he believed the drivers were responsible and that the vehicles were safer and cleaner than other cabs").

115. Loughan v. Firestone Tire & Rubber Co., 749 F.2d 1519, 1523 (11th Cir. 1985) (finding evidence of drinking over an extended period of time, coupled with evidence of a regular practice of carrying a cooler of beer in a truck at or about the time of the accident, to sufficiently establish a habit for drinking); *see also* State v. Kately, 637 A.2d 214, 218 (N.J. Super. Ct. App. Div. 1994) (noting habit evidence of attending nightly drinking parties).

116. *See, e.g.*, People v. LoPiccolo, 733 N.Y.S.2d 560, 561 (N.Y. App. Div. 2001) (establishing it was the "business and personal practice of the victim to carry large sums of money on his person"); State v. Brown, 543 S.E.2d 552, 555 (S.C. 2001) (holding evidence of routinely possessing a gun to constitute admissible habit evidence).

117. Maynard v. Sena, 125 A.3d 541, 547 (Conn. App. Ct. 2015) (allowing habit testimony that a doctor "wore gloves every time he performed a surgical procedure in his office during his thirty year career"); Rosebrock v. E. Shore Emergency Physicians, LLC, 108 A.3d 423, 435 (Md. Ct. Spec. App. 2015) (allowing testimony of a doctor's response to a patient on a backboard to be admissible habit after the doctor testified they always conducted the same procedure in the same way); Hoffart v. Hodge, 609 N.W.2d 397, 403 (Neb. Ct. App. 2000) (allowing evidence of a doctor's "habit or routine of advising his patients about mammogram failure rates").

118. Brokamp v. Mercy Hosp. Anderson, 726 N.E.2d 594, 605 (Ohio Ct. App. 1999) (allowing testimony of the location of where a nurse gave a shot every time).

119. *See, e.g.*, Meyer v. United States, 464 F. Supp. 317, 321 (D. Colo. 1979), *aff'd,* 638 F.2d 155 (10th Cir. 1980) (allowing habit evidence of a dentist "routinely and regularly" informing patients of risks involved in molar extractions); Rivera v. Anilesh, 869 N.E.2d 654, 655 (N.Y. 2007) (holding that a "dentist's routine procedure for administering an anesthetic injection is admissible

the tort or wrongful death contexts, habit has been introduced to show motorcycle speed,[120] care in setting a train handbrake,[121] and how individuals navigated particular crosswalks.[122] At the same time, habit evidence has been disallowed in federal and state cases either because a factual record could not be developed,[123] the evidence touched on issues of negligence,[124] the evidence suggested propensity,[125] or the evidence was not specific enough to be an identifiable trigger for repetitive response.[126]

Despite evident inconsistencies, the conclusion about modern practice is that habit evidence exists as a tremendously open doctrine—limited neither by history nor theory. Habit is available in almost every case to bolster direct evidence, fill in factual gaps, or provide predictive inferences about what might have happened.

As we know from our personal lives, habits are everywhere. The problem, of course, is that habits are difficult to see in the real world. Although there are no limits on who can testify or any requirements of

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as habit evidence supporting an inference that the same procedure was used when treating the patient").

120. Zempel v. Slater, 182 S.W.3d 609, 618 (Mo. Ct. App. 2005) (holding that "evidence that [the motorcycle driver] *always* obeyed the speed limit when riding with his sons is proper habit evidence").

121. Burchfield v. CSX Transp., Inc., No. 107-CV-1263, 2009 WL 1405144, at *3 (N.D. Ga. May 15, 2009) (finding testimony of always setting a handbrake admissible as habit evidence).

122. Charmley v. Lewis, 729 P.2d 567, 568 (Or. 1986) (allowing evidence of the plaintiff's "'habit' of invariably using a particular crosswalk in crossing a street at a certain intersection"); Glatt v. Feist, 156 N.W.2d 819, 828 (N.D. 1968) ("We believe that the rejected evidence was competent to go to the jury upon the theory that the plaintiff had been in the habit of crossing Main Street in returning from church at the point east of the crosswalk.").

123. Wanke v. Lynn's Transp. Co., 836 F. Supp. 587, 594 (N.D. Ind. 1993) (holding that a single speeding ticket was inadmissible as habit evidence under FRE 406 because "[o]ne incident simply is too few" to demonstrate a habit of speeding); United States v. Newman, 982 F.2d 665, 668 (1st Cir. 1992) (in a case involving a correctional officer's habit of handcuffing, the court found that "appellant provided no foundation for assessing the adequacy of the sampling" because there was no overall number to compare the particular action).

124. Jones v. S. Pac. R.R., 962 F.2d 447, 449–50 (5th Cir. 1992) (finding that nine violations of negligent operation over a twenty-nine-year-old career was not habit evidence of carelessness for a railroad).

125. State v. Brown, 543 S.E.2d 552, 554 (S.C. 2001) (disallowing evidence of a general propensity to be violent as evidence of habit).

126. Simplex, Inc. v. Diversified Energy Sys., Inc., 847 F.2d 1290, 1293–94 (7th Cir. 1988) (rejecting contention that "late and inadequate performance of other contracts approaches the level of specificity necessary to be considered semi-automatic conduct"); Bad Wound v. Lakota Cmty. Homes, Inc., 603 N.W.2d 723, 729 (finding prior management changes within the same company insufficient to constitute habit because of the different circumstances of each employment decision).

corroboration, someone still needs to know about the habit to testify about it. For this reason, the doctrine has remained an afterthought in practice—available, but not always used, and when used, inconsistently applied.

The question is whether the new ability to visualize and predict new forms of habits and patterns through smart data will change this reality. With new data-generating objects and digital services, suddenly our habits are visible and measurable. In fact, as the next Section discusses, the rise of the Internet of Things and the growth of our digital lives is based on visualizing and quantifying those once-hidden activities. The potential for habit evidence to play a more central role in trial exists because the data trails around us reveal so many regularized patterns of life.

II. THE INTERNET OF THINGS, HABITS, AND DIGITAL PATTERNS

Habits involve both regular and semiautomatic responses to particular triggering events, and smart devices are quickly becoming the digital monitors of those patterns. The insight arising from the Internet of Things is that we can now visualize and map patterns into measurable data.[127] Almost every physical object, home, workspace, and even our bodies can be converted into a "smart" data-collecting portal capable of identifying external triggering events and human responses.[128] As a result, we have quantifiable information about our regular patterns, activities, and reactions.

Mapping past actions, however, is not the only innovation emerging from the embrace of the quantified life. The ultimate goal of the Internet of Things convenience culture is to predict your habits and offer things you need before you know you need them.[129] Prediction is

127. *See generally* Scott J. Shackelford & Scott O. Bradner, *Have You Updated Your Toaster? Transatlantic Approaches to Governing the Internet of Everything*, 72 HASTINGS L.J. 627, 632 (2021) ("[T]he term [Internet of Things] today is widely used to refer generally to a host of efforts to make our governments, businesses, and even our bodies, increasingly interconnected and hence, to some degree, 'smart.' It features a wide range of products that 'can be monitored, controlled[,] and linked.'").

128. DAVID ROSE, ENCHANTED OBJECTS: DESIGN, HUMAN DESIRE, AND THE INTERNET OF THINGS 7 (2014) (describing the rise of smart devices, which are likened to enchanted magical objects).

129. *See generally* RICHARD L. RUTLEDGE, AARON K. MASSEY, ANNIE I. ANTÓN & PETER SWIRE, DEFINING THE INTERNET OF DEVICES: PRIVACY AND SECURITY IMPLICATIONS, GEORGIA INSTITUTE OF TECHNOLOGY TECHNICAL REPORT GIT-GVU-14-01 (2014), https://smartech.gatech.edu/bitstream/handle/1853/52020/plsc2014-IoD.pdf

central to the value of algorithmic tracking, and this prediction—the idea that because of past actions a future action is more likely to occur—is, of course, an underlying theory of habit evidence.[130]

Two caveats are in order. First, the potential scale and scope of data collection depends on adoption of these technologies. Recent forecasts predict that there will be seventy-five billion Internet of Things devices in our lives by 2025.[131] But these forecasts are generalized and will impact different communities in different ways. Second, and relatedly, the tracking capabilities of digital technology currently apply to a privileged and high-income world where consumers and businesses can afford to purchase smart technology.[132] In many areas of the United States, these smart devices will take longer to be adopted, meaning large gaps of data will remain. The digital divide is real, and interestingly, affluent consumers may be more ensnared in the grasp of sensor-surveillance than those who cannot afford smart devices.

This Section examines the growing scope of Internet of Things technologies with the goal to show how regularized patterns and predictions that are observable through data can be turned into admissible habit evidence. It explores how Internet of Things devices track our habits, focusing on the contextual patterns arising from homes, persons, travel, and work. These patterns offer potential clues for creative litigants thinking about how to prove particular points in court. Whether arising from a tort suit, a criminal case, or another legal matter, the regularized digital patterns will be useful to either resolve the contested factual point as direct evidence or suggest a predictable pattern as admissible habit evidence.

[https://perma.cc/47FJ-TPLA] (describing predictive uses of the Internet of Devices such as being able to turn the heat on and off when a person leaves their home or order food they need through a smart refrigerator).

130. *See infra* Part III.A.3

131. *See* Alix Pressley, *Securing the Internet of Things in the 5G Era*, INTELLIGENT CIO (July 15, 2021), www.intelligentcio.com/eu/2021/07/15/securing-the-internet-of-things-in-the-5g-era [https://perma.cc/NKT6-VNGM].

132. The first iteration of smart device adoption has been led by those with more economic means due to the high costs of the devices. *See, e.g.*, Audrey Noble, *A Look Inside the Amazing Smart Home Systems that Rich People Use*, BUS. INSIDER (July 29, 2018, 9:39 AM), www.businessinsider.com/smart-home-tech-that-rich-people-use-2018-7 [https://perma.cc/5YX6-YKNU].

A. Sensorveillance Technology

The technology behind data-driven personal surveillance starts with sensors.[133] Small, ubiquitous, and cheap, sensors are the reason why ordinary objects are considered "smart."[134] In simple terms, sensors link objects through the internet, WiFi, Bluetooth, Matter, or other connected technologies.[135] Data is recorded on the object or in a localized hub and can be sent to third party cloud providers or services for analysis, monitoring, or alerts.[136] Sensors need not be connected to each other or to other systems, but much of the promised convenience comes from the ability to use the data through interconnected services.[137] This sensor self-surveillance or "sensorveillance"[138] will reveal daily patterns like nothing has before.

In fact, the rise of digital smart objects has led to several global trends including "the Quantified Self movement,"[139] "lifelogging,"[140]

133. Peppet, *supra* note 3, at 90; Julie Brill, *The Internet of Things: Building Trust and Maximizing Benefits Through Consumer Control*, 83 FORDHAM L. REV. 205, 211–12 (2014); Cunningham, *supra* note 9, at 380 ("Manufacturers engraft sensors into lightbulbs, toothbrushes, doorbells, garage doors, sprinkler systems, and slow-cookers—most of which monitor, collect, and transmit the occupant's data exhaust." (citations omitted)).

134. Many scholars, including this Author, have already detailed the technical and practical structure of the Internet of Things, or "sensorveillance." Ferguson, *The "Smart" Fourth Amendment*, *supra* note 8, at 560 (coining the term).

135. Brill & Jones, *supra* note 6, at 1186 ("A simple definition of the IoT is 'the concept of basically connecting any device with an on and off switch to the Internet (and/or to each other).'"); *see also* Simon Hill, *Here's What the 'Matter' Smart Home Standard Is All About*, WIRED (Oct. 4, 2022, 1:30 PM), https://www.wired.com/story/what-is-matter [https://perma.cc/DYQ7-6PLR] (describing Matter, the new open source smart home standard, which allows for interoperability among devices).

136. Swaroop Poudel, *Internet of Things: Underlying Technologies, Interoperability, and Threats to Privacy and Security*, 31 BERKELEY TECH. L.J. 997, 1005–06 (2016) ("IoT is intimately connected to the notion of big data . . . . The development of cloud computing has been of paramount importance to big data and will play a major role in the IoT infrastructure.").

137. Mark A. Lemley & Bryan Casey, *Remedies for Robots*, 86 U. CHI. L. REV. 1311, 1341 (2019) ("[T]he convenience of simply issuing a voice command to set a cookie timer, play a song, or order a cab can be too good to pass up. Yet, in exchange . . . we must also accept the reality of their 24-7 surveillance of our most intimate settings.").

138. *See* Ferguson, *The "Smart" Fourth Amendment*, *supra* note 8, at 560.

139. *See, e.g.*, *The Quantified Self: Counting Every Moment*, ECONOMIST (Mar. 3, 2012), www.economist.com/node/21548493 [https://perma.cc/CZU9-6E7M].

140. Jerry Kang, Katie Shilton, Deborah Estrin, Jeff Burke & Mark Hansen, *Self-Surveillance Privacy*, 97 IOWA L. REV. 809, 826 (2012) ("A Lifelog is an attempt to produce a complete multimedia record of one's entire sensory experience for permanent personal archive."); Anita L. Allen, *Dredging Up the Past: Lifelogging, Memory, and Surveillance*, 75 U. CHI. L. REV. 47, 48 (2008) ("The term 'lifelog' refers to a comprehensive archive of an individual's quotidian existence, created with the help of pervasive computing technologies.").

the invention of "enchanted objects,"[141] "autonomous vehicles,"[142] "smart cities,"[143] and the "The Internet of Everything."[144] As the next several subsections discuss, these digitally augmented things, people, and places offer new ways to trace patterns of probabilistic actions and automatic responses to specific triggers and, on occasion, to establish identity—all key aspects of traditional habit evidence.

1. *Habits at Home*. Smart homes reveal insights into daily patterns of domestic life.[145] Whether you want a smart fridge to order food when you run out[146] or a smart television to remember your favorite show,[147] the idea that your inanimate things can anticipate your preferences has some intuitive consumer appeal.[148] Accurate predictions from smart devices based on your data is the currency of the Internet of Things.

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141. ROSE, *supra* note 128.

142. *See generally* Dorothy J. Glancy, *Privacy in Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1171, 1210 (2012) (discussing the threats to privacy interests created by the use of autonomous vehicles).

143. Jesse Woo, *Beyond Mosaic Theory: Understanding Privacy Harms in Smart Cities Through a Complexity Theory Lens*, 106 IOWA L. REV. ONLINE 114, 120 (2021).

144. DAVE EVANS, THE INTERNET OF EVERYTHING: HOW MORE RELEVANT AND VALUABLE CONNECTIONS WILL CHANGE THE WORLD 1 (2012), https://www.cisco.com/c/dam/global/en_my/assets/ciscoinnovate/pdfs/IoE.pdf [https://perma.cc/656W-DQMP].

145. Caleb Garling, *Google's Purchase of Nest Gives It Entree into Homes*, S.F. GATE (Jan. 13, 2014), https://www.sfgate.com/tech/article/Google-s-purchase-of-Nest-gives-it-entree-into-5139771.php [https://perma.cc/WF3R-7UA9] ("Palo Alto's Nest is a flagship brand in the burgeoning Internet of Things—a catchphrase for a wave of tech innovations that could turn once-mundane appliances like ovens, thermostats, microwaves, fridges and garage-door openers into a network of devices that communicate with each other."); Janet Morrissey, *The Race To Create the Coolest Smart Home Devices Is Hotter Than Ever*, N.Y. TIMES (Jan. 15, 2019), www.nytimes.com/2019/01/15/business/the-race-to-create-the-coolest-smart-home-devices-is-hotter-than-ever.html [https://perma.cc/2AYM-TUY9].

146. Morrissey, *supra note* 145 ("With its Family Hub smart refrigerator, for example, you can view the contents of your refrigerator from a smartphone at work, use a grocery app like InstaCart or Amazon Prime Now to order any needed groceries for dinner, and have the food delivered before arriving home."); RUTLEDGE ET AL., *supra* note 129, at 7 (discussing a refrigerator that will order milk for you when you run out).

147. *See* Whitson Gordon, *How To Stop Your Smart TV from Tracking What You Watch*, N.Y. TIMES (July 23, 2018), www.nytimes.com/2018/07/23/smarter-living/how-to-stop-your-smart-tv-from-tracking-what-you-watch.html [https://perma.cc/7Q3W-KC5B]; 2 NAT'L INST. OF STANDARDS & TECH., GUIDELINES FOR SMART GRID CYBERSECURITY 27 (2010), http://nvlpubs.nist.gov/nistpubs/ir/2014/NIST.IR.7628r1.pdf [https://perma.cc/62BQ-KU68] (demonstrating how smart meter data reveals lifestyle and appliance use information).

148. Mary Ellen Callahan, *Open House: Connected Homes and the Curtilage Keynote, UNC Jolt 2016 Symposium*, 18 N.C. J.L. & TECH. 1, 5 (2016) ("[T]he sensors and the smart homes are looking for ways to save money, looking for patterns and ways to improve your quality of life along with non-obvious relationships.").

For example, you can buy a smart toilet to identify hidden health risks,[149] a smart bed to measure unconscious sleep habits,[150] and a smart toothbrush for regular dental hygiene.[151] The electrical infrastructure of your home can be mapped through smart outlets,[152] smart light bulbs,[153] and smart thermostats,[154] which use energy patterns to reveal internal movements within the house.[155] Security devices such as smart locks and security cameras keep burglars out but also capture when the homeowner leaves and with whom.[156] Other internal camera systems for security, pets, or babies monitor movements within the home's most private spaces and alert homeowners to unusual patterns of activity.[157] Of course, the offerings of smart objects for the home go well beyond necessity, to all sorts of less essential, even frivolous, smart

149. Navin Bondade, *The AI Toilets Will Scan Your Poop To Diagnose Your Ailments*, TECHGRABYTE (Nov. 12, 2018), https://techgrabyte.com/ai-toilets-scan-poop-diagnose-ailments [https://perma.cc/XGF4-RACL].

150. Brenda Stolyar, *Google's New Nest Hub Tracks Your Sleep and It Feels Very Judgy*, MASHABLE (Mar. 31, 2021), https://mashable.com/review/google-nest-hub-sleep-tracking-review [https://perma.cc/GZB8-6VA2].

151. Cat Ellis, *Internet Enabled Toothbrushes Seemed Like Complete Overkill Until I Tried One*, TECHRADAR (July 5, 2021), www.techradar.com/news/internet-enabled-toothbrushes-seemed-like-total-overkill-until-i-tried-one [https://perma.cc/5BZY-H9GT].

152. Jordan Robertson, *Your Outlet Knows: How Smart Meters Reveal Behavior at Home, What We Watch on TV*, BLOOMBERG (June 10, 2014, 9:29 PM), www.bloomberg.com/news/2014-06-10/your-outlet-knows-how-smart-meters-can-reveal-behavior-at-home-what-we-watch-on-tv.html [https://perma.cc/N8F2-ALUD].

153. Angela Watson, *Smart Homes: What You Need To Stay Private and Secure*, CHI. TRIB. (July 6, 2021, 6:54 PM), www.chicagotribune.com/consumer-reviews/sns-bestreviews-home-smart-what-you-need-to-secure-20210706-4byllrxzwfczho2334gyk2yere-story.html [https://perma.cc/2XUA-YH3W].

154. Cunningham, *supra* note 9, at 381 ("Data from the thermostat alone reveals when the user has been away from the home historically and when the user likely will be away from home in the future.").

155. Nur Lalji, *Featurization and the Myth of Data Empowerment*, 15 WASH. J.L. TECH. & ARTS 1, 14 (2019) ("Nest's Learning Thermostat . . . provides users with insight into 'their own data trail' by allowing them to see what information it has gleaned about a user's daily routine."); Matt Liebowitz, *Smart Electricity Meters Can Be Used To Spy on Private Homes*, NBC NEWS (Jan. 10, 2012, 4:03 PM), www.nbcnews.com/id/45946984/ns/technology_and_science-security/t/smart-electricity-meters-can-be-used-spy-private-homes [https://perma.cc/TE83-CEUR].

156. Stacy-Ann Elvy, *Hybrid Transactions and the Internet of Things: Goods, Services, or Software?*, 74 WASH. & LEE L. REV. 77, 100 (2017) ("IOT security cameras permit owners to remotely view security feeds and control the devices through a mobile application or a website without a physical video system.").

157. Brill & Jones, *supra* note 6, at 1192 ("Home security systems have upgraded from internal motion detectors and window sensors to devices that include not just a video camera but also sensors for air quality, motion, sound, temperature, and vibration.").

objects. Entertainment streams from screens, stereos, and gaming systems reveal what you are enjoying and suggest more of the same.[158] Digital assistants such as Google Home and Amazon Echo answer questions, and smart hubs such as Nest can coordinate activities and tasks within the house.[159] And while today's smart homes are selling a series of digital tools, the next generation systems will be selling not just self-awareness and energy efficiency, but more sophisticated services and software through those same devices.[160]

Critiques about capitalism, consumerism, and the erosion of privacy can and should be leveled at smart homes and surveillance consumerism.[161] But from an evidentiary perspective, digital trails will help reveal and predict the patterns of our lives.[162] These digital clues

158. *See* Geoffrey A. Fowler, *You Watch TV. Your TV Watches Back.*, WASH. POST (Sept. 18, 2019, 8:00 AM), www.washingtonpost.com/technology/2019/09/18/you-watch-tv-your-tv-watches-back [https://perma.cc/MDT8-S3BH]; Chris Matyszczyk, *Samsung's Warning: Our Smart TVs Record Your Living Room Chatter*, CNET (Feb. 8, 2015, 2:10 PM), www.cnet.com/news/privacy/samsungs-warning-our-smart-tvs-record-your-living-room-chatter [https://perma.cc/Z9X2-3ED6].

159. Arielle M. Rediger, *Always-Listening Technologies: Who Is Listening and What Can Be Done About It*, 29 LOY. CONSUMER L. REV. 229, 231 (2017); *see also* Sapna Maheshwari, *Hey, Alexa, What Can You Hear? And What Will You Do With It?*, N.Y. TIMES (Mar. 31, 2018), www.nytimes.com/2018/03/31/business/media/amazon-google-privacy-digital-assistants.html [https://perma.cc/H69F-NMWF].

160. Elvy, *supra* note 156, at 95 (recognizing that many times a single IoT device is selling a hybrid of goods, services, and software); *see also id.* at 98 ("IOT services, software and devices work together to measure consumption rates, collect, and transmit data about owners to companies, automatically order goods, and allow owners to remotely control multiple devices, among other things."); Jane E. Kirtley & Scott Memmel, *Rewriting the "Book of the Machine": Regulatory and Liability Issues for the Internet of Things*, 19 MINN. J.L. SCI. & TECH. 455, 466 (2018) ("The FTC reported that approximately 10,000 households using a single company's IoT home automation product can collectively 'generate 150 million discrete data points a day,' or about 'one data point every six seconds for each household.'" (citing FED. TRADE COMM'N, STAFF REPORT ON THE INTERNET OF THINGS: PRIVACY AND SECURITY IN A CONNECTED WORLD 14 (2015), https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf [https://perma.cc/AT9Q-N99Q])).

161. *See, e.g.*, Evan Selinger & Darrin Durant, *Amazon's Ring: Surveillance as a Slippery Slope Service*, 31 SCI. AS CULTURE 92, 92 (2021).

162. As one news report explains:

> Even when designed for limited functions, experts say, many of these Web-linked gadgets will record whatever they see and hear in homes, which could provide detailed dossiers on the people living there, especially when combined with what's amassed by other interconnected machines. The personal data revealed could include everything from your friends, hobbies and daily routines to your political views, religious affiliation and even your sexual activities.

Steve Johnson, *Internet of Things Will Transform Life, but Experts Fear for Privacy and Personal Data*, SAN JOSE MERCURY NEWS (Mar. 15, 2017, 4:15 PM), www.mercurynews.com/

offer a way to analyze contextual patterns—a morning bathroom ritual, the time you leave the house, or your late evening bedroom routines—and then predict specific triggers for activities and responses. From a probabilistic theory of habit analysis, one can count and predict every time you make coffee,[163] go to the bathroom, or jump on a Peloton.[164] From a psychological theory of habit, you might know that each of those activities is accompanied close in time by turning on tap water. Although this data is not personally revealing in the ordinary course, such activities might become so in trial. For example, evidence of movement around the house could become evidence to support unemployment insurance fraud if claimants assert they were bedridden and unable to work. Or patterns of movement in a house could identify a person in a particular part of a house at a particular time, which might be relevant in a criminal investigation.[165]

In a handful of homicide cases, smart home devices have already been sought as digital witnesses.[166] In the context of direct digital evidence rather than inferential habit evidence, smart home technologies have been used to establish the timing of a crime and whether a digital assistant was queried in a way that might suggest criminal culpability.[167] In Arkansas and New Hampshire, prosecutors subpoenaed Amazon for any Echo recordings in two separate murder

2014/11/01/internet-of-things-will-transform-life-but-experts-fear-for-privacy-and-personal-data [https://perma.cc/9WA6-ZUS6].

163. *See generally* Emily Reynolds, *The Internet of Things Wants To Make Your Coffee Too*, WIRED (Mar. 1, 2016, 3:49 PM), www.wired.co.uk/article/internet-connected-coffee-machine [https://perma.cc/3QJW-LHK6] (discussing how coffee machine makers, like Nespresso, are launching smart home coffee machines).

164. Nikolina Ilic, *Could Your Peloton Be Spying on You?*, WOMEN'S HEALTH (June 21, 2021), www.womenshealth.com.au/could-your-peloton-be-spying-on-you [https://perma.cc/H8PA-4S73].

165. *See* James O'Toole, *Cops Can Access Your Connected Home Data*, CNN BUS. (June 16, 2014, 2:25 PM), https://money.cnn.com/2014/06/16/technology/smart-home-footage/index.html [https://perma.cc/SWK2-ASSU].

166. Ferguson, *The Internet of Things and the Fourth Amendment of Effects*, *supra* note 3, at 820–21 (describing the potential for police surveillance with Internet of Things devices); *see* Eldar Haber, *The Wiretapping of Things*, 53 U.C. DAVIS L. REV. 733, 735 (2019).

167. Meagan Flynn, *Police Think Alexa May Have Witnessed a New Hampshire Double Homicide. Now They Want Amazon To Turn Her Over*, WASH. POST (Nov. 14, 2018, 7:28 AM), www.washingtonpost.com/nation/2018/11/14/police-think-alexa-may-have-witnessed-new-hampshire-double-slaying-now-they-want-amazon-turn-her-over [https://perma.cc/3TEX-944J]; Eliott C. McLaughlin & Keith Allen, *Alexa, Can You Help with this Murder Case?*, CNN BUS. (Dec. 29, 2016, 1:48 AM), http://edition.cnn.com/2016/12/28/tech/amazon-echo-alexa-bentonville-arkansas-murder-case-trnd/index.html [https://perma.cc/2MXS-3QTC].

cases.[168] In Florida, the defense sought exculpatory evidence from an Echo system in a self-defense homicide case.[169] Ring doorbells, nanny cams, and a host of smart surveillance devices are making their way into criminal cases as direct evidence of thefts, burglaries, and other crimes.[170]

But the growing role of inferential digital clues and patterns will also start to play a role, bolstering direct digital evidence with habits that support the direct evidence. For example, to support other evidence of cocaine distribution in a home, prosecutors might seek to introduce a weekly sampling of waste water that shows elevated levels of cocaine residue coming from the house.[171] Or, to support other evidence of marijuana cultivation, police might seek to gather monthly utility data showing elevated electricity consumption.[172] Or, geolocation data about trips to a particular house on a regular schedule

168. Flynn, *supra* note 167; McLaughlin & Allen, *supra* note 167.

169. NBC News, *Amazon's Alexa May Have Witnessed Alleged Florida Murder, Authorities Say*, LOCAL3NEWS (Mar. 23, 2022), www.wrcbtv.com/story/41263095/amazons-alexa-may-have-witnessed-alleged-florida-murder-authorities-say [https://perma.cc/6M9N-64U9]; Rafael Olmeda, *Alexa, Is He Guilty of Murder? Amazon Device May Have Heard Slaying, Cops Say*, S. FLA. SUN SENTINEL (Oct. 31, 2019, 6:57 PM), www.sun-sentinel.com/news/crime/fl ne-amazon-alexa-murder-investigation-20191031-qccpvdl6kng5hcx3z6eusxa264-story.html [https://perma.cc/8KCW-QUY5].

170. Caroline Haskins, *New Map Reveals That at Least 231 Cities Have Partnered with Ring*, VICE (Aug. 8, 2019, 12:05 PM), www.vice.com/en_us/article/qvg4vx/new-map-reveals-that-at-least-231-cities-have-partnered-with-ring [https://perma.cc/3RXB-XDWF]; Caroline Haskins, *Police Promised Witnesses Free Ring Surveillance Cameras If They Testified Against Neighbors*, VICE (Aug. 15, 2019, 2:13 PM), www.vice.com/en_us/article/kz4agn/police-promised-witnesses-free-ring-surveillance-cameras-if-they-testified-against-neighbors [https://perma.cc/3RJ3-8UCP]. *See generally* Lindsey Barrett, *Carpenter's Consumers*, 59 WASHBURN L.J. 53, 83 (2020) (describing how prosecutors used cell-site location information gathered without a warrant to convict Timothy Carpenter).

171. Christopher L. Hering, Note, *Flushing the Fourth Amendment Down the Toilet: How Community Urinalysis Threatens Individual Privacy*, 51 ARIZ. L. REV. 741, 742–43 (2009) (discussing the detection of illegal narcotics in wastewater).

172. As Megan McLean explains:

> Typical smart meters record energy usage every fifteen minutes, while advanced versions may shrink this window to as few as six seconds or even permit measurement in real time. Individual appliances increasingly have unique energy consumption patterns. For example, a refrigerator draws power in a different way than a television, a respirator, or a marijuana grow light. As a result, there is a concern that these data may be aggregated over time and analyzed to reveal personal information including medical conditions, illicit habits, or other private details about a person's home life.

See Megan McLean, Note, *How Smart Is Too Smart?: How Privacy Concerns Threaten Modern Energy Infrastructure*, 18 VAND. J. ENT. & TECH. L. 879, 885 (2016) (footnotes omitted).

might indicate patterns of drug sales.[173] These facts could be admissible as direct evidence if one could show how cocaine residue, electrical outputs, or regular trips were relevant to a particular suspect. They are also, however, admissible as habit evidence with a potentially more forgiving evidentiary foundation under FRE 406. Whether or not these activities prove direct evidence of a crime, they certainly establish habits and patterns of people in the home, supporting an inference of involvement. The point is that patterns of the home, when digitized and quantified in code, will be seen as potential habits relevant to prove particular facts in trial.[174]

2. *Habits of the Person*. The Internet of Things also involves wearable technology designed to improve personal health and safety.[175] The ubiquitous smart watch[176] or fitness tracker[177] offers real-time monitoring of one's bodily response to certain events. Sensors are being woven into clothing,[178] and apps[179] are being built to mine fitness

173. Bert-Jaap Koops, Bryce Clayton Newell & Ivan Skorvanek, *Location Tracking by Police: The Regulation of 'Tireless and Absolute Surveillance*,' 9 U.C. IRVINE L. REV. 635, 638 (2019) ("[L]ocation information can be vital for pinning down a suspect to a crime scene or providing them with an alibi. Indeed, real-time and historical geolocation data has become a common piece of evidence collected in criminal investigations.").

174. This might become especially prevalent in domestic violence cases in the home. *See* Tabetha Soberdash, *Domestic Violence in the Era of the Smart Home: Using Smart Home Technology Evidence To Help Victims of Abuse*, 27 RICH. J.L. & TECH. 1, 3, 4–5 (2020).

175. Brill & Jones, *supra* note 6, at 1190 ("Health, and safety are the biggest drivers of most wearable IoT devices used to monitor the body.").

176. There were an estimated one hundred million Apple Watches sold as of February 2021. Halyna Kubiv, *How Many Apple Watches Has Apple Sold?*, MACWORLD (Feb. 12, 2021, 12:51 PM), www.macworld.co.uk/news/how-many-apple-watches-sold-3801687 [https://perma.cc/V4LM-AKA5].

177. Craig Konnoth, *Medicalization and the New Civil Rights*, 72 STAN. L. REV. 1165, 1256 (2020) ("[A]s of 2019, 'nearly half of Americans (45%)' have used a fitness tracker or mobile health app, or both, at some point."). *See generally* Justin McCarthy, *One in Five U.S. Adults Use Health Apps, Wearable Trackers*, GALLUP (Dec. 11, 2019), https://news.gallup.com/poll/269096/one-five-adults-health-apps-wearable-trackers.aspx [https://perma.cc/9PZ7-YZS8] (noting that approximately one-fifth of all U.S. adults currently use a fitness tracker).

178. Andrea M. Matwyshyn, *The Internet of Bodies*, 61 WM. & MARY L. REV. 77, 97 (2019) ("Clothing company L.L.Bean has announced that it is connecting its coats and boots to the blockchain using sewn-in sensors, becoming the latest participant in the broader fashion trend of connected clothing with human-computer interfaces.").

179. Jianyan Fang, *Health Data at Your Fingertips: Federal Regulatory Proposals for Consumer-Generated Mobile Health Data*, 4 GEO. L. TECH. REV. 125, 126–27 (2019) ("Statistics show that around 318,000 mobile health (mHealth) apps are now available in major app stores, and the global mHealth app market is expected to reach 111 billion U.S. dollars by 2025."); *see*

data for insights at the highest and lowest levels of sport. For some people, these wearables[180] allow them to quantify the impact of a personal training regime.[181] Other people simply seek greater insight on daily well-being, as reflected in their blood pressure, heart rate, steps walked, and other trackable metrics.[182] Yet others use smart devices to track their fertility and reproductive health[183] or, later, their

also id. at 127 ("mHealth technologies are allowing the devices we take everywhere to constantly collect and share our health data.").

180. *See generally* Bill Wasik, *Why Wearable Tech Will Be as Big as the Smartphone*, WIRED (Dec. 17, 2013, 6:30 AM), http://www.wired.com/gadgetlab/2013/12/wearable-computers [https://perma.cc/3G5C-EY8Y] (discussing how "[a] new generation of wearable tech . . . will transform" how people experience the world); Matthew R. Langley, *Hide Your Health: Addressing the New Privacy Problem of Consumer Wearables*, 103 GEO. L.J. 1641, 1659 (2015) ("Consumer wearables present a new way for individuals to communicate sensitive, personal information about themselves.").

181. *See, e.g.*, Ginia Bellafante, *At the Gym, Abs and Stats*, N.Y. TIMES (Jan. 1, 2016), www.nytimes.com/2016/01/03/nyregion/orangetheory-workout-new-years-resolution-fitness.html [https://perma.cc/6T9S-VKPF] (discussing the rise of fitness training based on wearable devices that display fitness progress in real time); Roy Wallack, *Wearable Technology Catapulting Health and Fitness into Future*, L.A. TIMES (Jan. 23, 2015, 12:49 PM), www.latimes.com/health/la-he-future-wearables-20150124-column.html [https://perma.cc/6YH3-YD9F].

182. As Adam D. Thierer explains:

> As they grow more sophisticated, wearable health devices will help users track, and even diagnose various conditions, and potentially advise a course of action or, more simply, remind users to take medications or contact medical professionals as necessary. In the process, these health and fitness devices and applications could eventually become "lifestyle remotes" that help consumers control or automate many other systems around them, regardless of whether they are in their homes, offices, cars, or the like.

Adam D. Thierer, *The Internet of Things and Wearable Technology: Addressing Privacy and Security Concerns Without Derailing Innovation*, 21 RICH. J.L. & TECH. 1, 19 (2015) (footnotes omitted); *see* Parmy Olson, *Wearable Tech Is Plugging Into Health Insurance*, FORBES (June 19, 2014, 1:26 PM), www.forbes.com/sites/parmyolson/2014/06/19/wearable-tech-health-insurance [https://perma.cc/KN4A-CH6C].

183. As Kate Clark explains:

> These trackers, such as Ovia or Flo, not only track when a woman's period occurs, but also the emotional and physical symptoms that occur over the course of their cycle. In order to do so, the apps ask women to input information about their symptoms and activities. Flo, for example, asks users to input the nature of their menstrual flow, sex drive and sexual history, mood, stress level, physical symptoms, and alcohol consumption, among other things. Users are not just asked to provide this information during menstruation, but every day.

Kate Clark, *It's a New Era for Fertility Tech*, TECHCRUNCH (Feb. 28, 2019, 4:10 PM), https://techcrunch.com/2019/02/28/its-a-new-era-for-fertility-tech [https://perma.cc/WC4E-AP3J]; *see* Nur Lalji, *Featurization and the Myth of Data Empowerment*, 15 WASH. J.L. TECH. & ARTS 1, 8 (2019).

baby's fetal health.[184] And many families are adopting "lifelogging"[185] to monitor older relatives who may have long-term health challenges.[186] Scholars such as Andrea Matwyshyn[187] and Scott Peppet[188] have identified the evolution of these smart sensors as they shift from the Internet of Things to the "Internet of Bodies."[189] The truth, of course, is that the Internet of Bodies is really just surveillance of our habits, broken down into measurable and predictable digital clues. Every byte of data, including our reflexive responses to external stimuli, is captured, crunched, and monetized.

For example, in a domestic violence assault prosecution, an Apple watch might be able to collect sensor data about elevated heartbeats

184. *See* Fatemeh Sarhaddi, Iman Azimi, Sina Labbaf, Hannakaisa Niela-Vilén, Nikil Dutt, Anna Axelin, Pasi Liljeberg & Amir M. Rahmani, *Long-Term IoT-Based Maternal Monitoring: System Design and Evaluation*, SENSORS, Mar. 24, 2021, at 2 ("IoT-based systems can provide cost-efficient health monitoring service for pregnant women in everyday settings. Recent studies show that such remote health monitoring systems can improve health outcomes for both mother and baby during pregnancy and the postpartum." (footnotes omitted)).

185. Alex Mihaildis & Liane Colonna, *A Methodological Approach to Privacy by Design Within the Context of Lifelogging Technologies*, 46 RUTGERS COMP. & TECH. L.J. 1, 1–2 (2020) ("Lifelogging technologies promise to manage many of the concerns raised by population aging. The technology can be used to predict and prevent disease, provide personalized healthcare, and to give support to formal and informal caregivers.").

186. Brill & Jones, *supra* note 6, at 1191 ("Aging is another growing market for the IoT, with companies like BodyGuardian . . . offering a sensor system that remotely reads a patient's heart and respiration rates, and activity level. The sensors allow a user's family or physicians to monitor the patient and call for medical attention if necessary.").

187. *See* Matwyshyn, *supra* note 178, at 94 ("The first generation of [Internet of Bodies] IoB devices has already become a familiar fixture in our lives. These devices are seemingly ubiquitous, including everything from 'lifestyle' connected fitness tracking devices and 'smart' glasses to 'smart' exoskeletons, connected breast pumps, and brain-sensing headbands." (citations omitted)); *see also id.* at 103 (describing second-generation IoB as "devices where a portion of the device resides inside the body or accesses the body by breaking the skin" and explaining that "pacemakers have long included digital components, and cochlear implants now include functionality reliant on Bluetooth. Digital pills (already approved for the market by the FDA) rely on a 3D-printed circuit and a transmitter inside a capsule" (citations omitted)).

188. As Scott R. Peppet explains:

> There are five basic types of personal health monitors, in order from least physically invasive to most invasive: (1) countertop devices (such as a blood-pressure monitor or weight scale); (2) wearable sensors (such as an arm or wrist band); (3) intimate contact sensors (such as a patch or electronic tattoo); (4) ingestible sensors (such as an electronic pill); and (5) implantable sensors (such as a heart or blood health monitor).

Peppet, *supra* note 3, at 98–99 (citations omitted).

189. Matwyshyn, *supra* note 178, at 101 ("Building on the era of the Quantified Self, the age of the Internet of Bodies presents the next iteration of these concerns: IoB adds legal concerns regarding the *physical safety* and continued functionality of the attached human bodies themselves.").

and blood pressure during the assault. But, if that information were not available for some reason, one might be able use the past patterns of elevated heartbeats and location data of the two family members to show that when the abuser and the victim were in close proximity, there was a repeated pattern of heightened physical reactions consistent with fear and anxiety. Or in some cases, a lawyer might use both forms of evidence—direct digital evidence and habit evidence—to support a case. The digital habit of repeated physical reactions to trauma and violence might reveal itself in the data.

Cardiologists and other medical professionals are also experimenting with smart devices to monitor patients,[190] with new innovations such as smart pill bottles,[191] smart bandages,[192] and biological implants[193] being invented every year. The goal appears to be a form of trackable precision medicine that provides real-time health insights about patients' bodies outside the doctor's office.[194] This data-driven medicine promises not only to mine existing health data, but also to prompt patients to create healthy habits in light of digital prompts. The nudge to exercise, take your insulin, remember to take your pills, or measure your blood pressure or heart rate becomes a digitally mediated habit—both created and measured by the technology. For example, in a prosecution involving conduct by an individual who regularly took antipsychotic medications, the pattern of taking pills or gaps therein might become a fact to support or defend the accused. The digital pattern of pill taking might be relevant either

190. Thierer, *supra* note 182, at 33–34 ("CardioMEMS HF System uses a wireless sensor, implanted in the pulmonary artery, to transmit health information to an external device, and 'then [it] forwards the data to the patient's medical team.'").

191. ROSE, *supra* note 128, at 9 (describing a "magic" pill bottle called "GlowCap," which glows and communicates via the Internet).

192. James Gerber, *Flexible Smart Sensors and the Future of Health*, ENGADGET (Sept. 21, 2015, 1:48 AM), www.engadget.com/2015/09/21/flexible-smart-sensors-and-the-future-of-health [https://perma.cc/E7NP-8BDA].

193. Keiron Monks, *Forget Wearable Tech, Embeddable Implants Are Already Here*, CNN (Apr. 9, 2014, 1:08 PM), www.cnn.com/2014/04/08/tech/forget-wearable-tech-embeddable-implants [https://perma.cc/P7ZG-VZJU].

194. David Shaywitz, *Wearables as Tools for Precision Medicine: Promise in Search of Evidence*, FORBES (Feb. 7, 2015, 8:43 PM), www.forbes.com/sites/davidshaywitz/2015/02/07/wearables-as-tools-for-precision-medicine-a-promise-in-search-of-evidence [https://perma.cc/LR89-ZFXJ] ("The theory is compelling—with the opportunity to monitor patients more comprehensively, and track patients in a fashion that more closely follows the contours of their lives, it should be possible to derive a more complete dataset that enables useful subgroups to be identified.").

as direct evidence or indirect habit evidence, with the latter being a second way to get the data admitted.

Two key points emerge. The first is that personal habits are now made visible by data collection.[195] Proof of our personal activities exists in quantified form. The second is that data can support the underlying theory of habit evidence as being a particularized responsive event to a particular triggering event. We can see both the event and the response time to the event in new ways. Because smart technology was designed to recognize and predict patterns in daily life, it does a good job of identifying those triggers and responses.[196] Simply put, the digital prompts and predictions in a smart watch arise because of pattern recognition built within the technology. The daily prompt to walk more or breathe deeply comes from tracking the past habits of movement or patterns.[197] As the devices become more interconnected with bodies and clothes, the scale and detail of personal collection will grow more inescapable.[198] This data will be available as trial evidence, even if the individual wearing the device did not think it would ever become a part of a criminal or civil case.[199] Of course, while the volume of personal data creates a host of issues around error, bias,[200] and privacy concerns, the capacity to quantify and visualize individual human actions on a

195. *See Counting Every Moment*, ECONOMIST (Mar. 3, 2012), www.economist.com/technology-quarterly/2012/03/03/counting-every-moment [https://perma.cc/7AYB-FC98] (identifying the "belief that gathering and analysing data about [one's] everyday activities can help . . . improve [one's] li[fe]").

196. Konnoth, *supra* note 177, at 1255–56 ("[A]n increasing number of individuals use devices to get information about their bodies which, in turn, affects how they see themselves. Self-tracking devices generate data about steps walked, heartbeat, calories burned and consumed, sleep patterns, and brainwaves, among other things; apps help analyze this data.").

197. Lalji, *supra* note 183, at 2–3 ("What was once a bug—the unknowable and seemingly unending troves of data that companies have collected about us—is now its feature, by making users' data trails visible, accessible, and interactive.").

198. Mihaildis & Colonna, *supra* note 185, at 13 ("When lifelogging technologies are embedded into the fabric of everyday life as well as into human flesh, it becomes increasingly difficult to relay the surveillance capabilities of these tiny, versatile objects in a way that individuals can fully understand their power.").

199. *See* Timothy L. Fort, Anjanette H. Raymond & Scott J. Shackelford, *The Angel on Your Shoulder: Prompting Employees To Do the Right Thing Through the Use of Wearables*, 14 NW. J. TECH. & INTELL. PROP. 139, 149 (2016) ("Wearables that monitor an individual's behavior may be able to alert individuals to behavioral patterns of which they had no conscious awareness.").

200. *Healgorithms: Understanding the Potential for Bias in mHealth Apps*, CTR. FOR DEMOCRACY & TECH. (Sept. 13, 2018), https://cdt.org/insight/healgorithms-understanding-the-potential-for-bias-in-mhealth-apps [https://perma.cc/M7GY-YAMR].

daily, weekly, and annual basis offers real power to track regularized patterns of behavior.

Direct data from health devices are already finding their way into criminal cases. In one case, a Fitbit undermined an alibi defense when the data from the device undercut the timeline of the main suspect; in another case, a Fitbit provided an alibi that exonerated a man from a murder charge.[201] In yet another case, a smart pacemaker's recording of a heartbeat undermined a suspect's version of what happened before a fire.[202] Of course, more privacy-invasive criminal uses may also arise. A smart watch will be able to register the biological effects of cocaine or heroin after use.[203] A smart pill bottle might reveal an addiction to opioids if taken too often. A fertility app might reveal both a pregnancy and an abortion, which in some states might be considered a criminal act.[204] The uncomfortable reality is that these personal habits will become direct and circumstantial evidence in court. In fact, they may become the central source of evidence in cases involving injury, contested negligence actions, and criminal acts.

3. *Habits of Movement*. Smart sensors reveal patterns of movement. Most obviously, smart cars and smart phones with tracking apps reveal public trips though geolocation technology and thus, inferentially, private activities at those locations. Although

201. *Husband Sentenced to 65 Years in Fitbit Murder Case*, AP NEWS (Aug. 18, 2022), https://apnews.com/article/shootings-597c5b876c1f7de77fcde24621ec5e94 [https://perma.cc/H8HD-XAEM]; Erin Moriarty, *21st Century Technology Used To Help Solve Wisconsin Mom's Murder*, CBS NEWS (Oct. 20, 2018, 10:30 PM), www.cbsnews.com/news/the-fitbit-alibi-21st-century-technology-used-to-help-solve-wisconsin-moms-murder [https://perma.cc/DD83-PUSP].

202. Cleve R. Wootson Jr., *A Man Detailed His Escape from a Burning House. His Pacemaker Told Police a Different Story.*, WASH. POST (Feb. 8, 2017, 6:15 AM), www.washingtonpost.com/news/to-your-health/wp/2017/02/08/a-man-detailed-his-escape-from-a-burning-house-his-pacemaker-told-police-a-different-story [https://perma.cc/3Q84-L8WB].

203. Peppet, *supra* note 3, at 93 ("[A] fitness monitor's separate measurements of heart rate and respiration can in combination reveal not only a user's exercise routine, but also cocaine, heroin, tobacco, and alcohol use, each of which produces unique biometric signatures.").

204. Cynthia Conti-Cook, *Surveilling the Digital Abortion Diary*, 50 U. BALT. L. REV. 1, 22 (2020) (warning that "other types of digital evidence can also be culled to support a prosecution, including location-tracking data, website navigation histories, purchasing history, social media activity, wearable device data, data entered into apps, and home devices connected to the internet"); *see* Russell Brandom, Nicole Wetsman, Corin Faife & Mary Beth Griggs, *The Biggest Privacy Risks in Post-Roe America*, VERGE (June 27, 2022, 3:47 PM), https://www.theverge.com/23185081/abortion-data-privacy-roe-v-wade-dobbs-surveillance-period-tracking [https://perma.cc/XS74-9SUR].

discomforting to think about, the patterns of public travel and movement are easily monitored and mined for habits.

Smart cars are fundamentally computer sensors on wheels.[205] These sensors provide a host of information about the car, passengers, and movements.[206] At one level of data collection, almost all cars come equipped with event data recorders ("EDRs"), which collect information about the car should it be in a car crash.[207] More modern cars now also offer security systems that track location to offer immediate roadside assistance in the event of an emergency.[208] Other amenities in cars include geolocational maps for navigation, and Bluetooth and WiFi for entertainment systems, which allow for interactive communication with other devices.[209] These consumer

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205. Fowler, *What Does Your Car Know About You?*, *supra* note 5.

206. For a discussion of the makeup of sensors in smart and connected cars, see Roland L. Trope & Thomas J. Smedinghoff, *Why Smart Car Safety Depends on Cybersecurity*, 14 ABA SCITECH LAW. 8, 9 (2018).

> Connected cars contain more than 100 embedded and interconnected computerized Electronic Control Units (ECUs). ECUs operate a connected car's key features: powertrain (e.g., engine, transmission, drive-shaft) and chassis control (including steering, brakes, airbag, windshield wipers), as well as infotainment systems (e.g., navigation, telephone, entertainment) and telematics (e.g., crash reporting and emergency warning). Many of these ECUs engage in two-way communications (via USB, Bluetooth, Wi-Fi, the Internet, or cell-phone systems) via a communication interface.

Id. (footnotes omitted).

207. Peppet, *supra* note 3, at 104–05 (explaining that the National Highway Traffic Safety Administration "estimates that over 96% of 2013 vehicles—and most cars sold in the United States in the last twenty years—contain EDRs" and "requires that EDRs collect fifteen types of sensor-based information about a car's condition, including braking status, vehicle speed, accelerator position, engine revolutions per minute, safety-belt usage, air-bag deployment, and number and timing of crash events"); *see also* Michelle V. Rafter, *Decoding What's in Your Car's Black Box*, EDMUNDS (July 22, 2014), www.edmunds.com/car-technology/car-black-box-recorders-capture-crash-data.html [https://perma.cc/N6A4-FVMA] (describing how EDRs have been used by automakers to "provide information about the seriousness of an accident, and if a car was being operated properly when a crash occurred").

208. *See OnStar 101*, ONSTAR, www.public-safety.onstar.com/onstar-101 [https://perma.cc/G78P-38KF].

209. Marisa Tashman discusses how infotainment systems enable driver access to various applications via Bluetooth:

> Infotainment systems "generate data about the information and entertainment content choices of system users, their use of mobile applications and concierge services, their web browsing activity, social networking, voice, text, and email communications from the car," as well as personal contacts and calendar data . . . . Privacy concerns arise because these systems collect and share a broad range of information, from passwords and payment information, to frequented restaurants, location data, and the contacts stored in a driver's phone.

Marisa Tashman, *Who's Driving You? Driver Data Remains Unprotected Under COPPA and Shine the Light*, 50 LOY. L.A. L. REV. 423, 432 (2017) (quoting BC FREEDOM OF INFO. AND PRIV.

products offer convenience and entertainment but with the privacy cost of revealing tastes, interests, and preferred activities.[210] For example, when your gas gets low, a navigation system can direct you to your nearest gas station, but only because it is tracking your location. The sophistication of automotive telematics[211] has grown due to real-time tracking as insurance companies have begun offering insurance deals based on real-time driving.[212] Insurance companies now mine patterns of travel and habits of safe driving[213] in addition to other clues about

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ASS'N, THE CONNECTED CAR: WHO IS IN THE DRIVER'S SEAT? 65 (2015), https://fipa.bc.ca/wp-content/uploads/2018/01/CC_report_lite.pdf [https://perma.cc/5K2H-3GPU]).

210. Brett Berk, *The Unending Struggle To Make Your Car Feel Like Your Phone*, WIRED (May 13, 2017, 7:00 AM), www.wired.com/2017/05/unending-struggle-make-car-feel-like-phone [https://perma.cc/ACX4-NGEQ] (explaining that "car companies can provide a myriad of push marketing opportunities reminding you to buy yourself a latte or suggest a route that takes you by a new lunch spot you might like" by "connecting the vehicle infotainment system to real-time location data, and pegging it to your daily calendar and commute, your to-do lists, your learned behavior"); Michael Froomkin & Zak Colangelo, *Privacy as Safety*, 95 WASH. L. REV. 141, 200 (2020) ("Connected cars can also be very invasive. While yesterday's drivers could reasonably think of their in-car time as a private moment, today's BMWs come with Alexa built-in, and perhaps listening in as well.").

211. Alexander B. Lemann further details the mechanics of vehicle telematic devices:

> A modern telematics device is a plastic cartridge roughly the size of your palm. It plugs into a diagnostic port called an OBD port, which can be found underneath the dashboard of every car manufactured in America after 1996. Once installed, the device collects data for wireless transmission to an insurance company, including how fast your car is moving, when, for how long, and in some cases where you drive, and the g-forces your car experiences as it accelerates, brakes, or maneuvers around turns.

Lemann, *supra* note 5, at 56.

212. Nancy B. Rapoport and Joseph R. Tiano, Jr. detail the extent of real-time monitoring:

> Sensors capture a car's speed, brake application, airbag deployment, seatbelt use, steering angles, A/V usage, and similar factors. The captured data is not just limited to vehicle performance but includes personal information, too, such as driver weight, music tastes, and places visited, including fast-food drive-throughs. Rather than relying solely on demographic data (application forms and driving history), insurers can leverage behavioral data by "watching" a driver operate a vehicle for a little bit and determining an underwriting score based upon the driver's actual driving history.

Nancy B. Rapoport & Joseph R. Tiano, Jr., *Using Data Analytics To Predict an Individual Lawyer's Legal Malpractice Risk Profile: Becoming an LPL "Precog,"* 6 U. PA. J.L. & PUB. AFFS. 267, 281 (2020).

213. Lemann, *supra* note 5, at 61 ("Several large car insurance companies offer their customers potential discounts on premiums in exchange for voluntarily using telematics devices and, in some cases, their own smartphones to monitor their driving behavior in real time and send the resulting data to the insurer."); *see also id.* at 62 (explaining that "Progressive's 'Snapshot' device tracks a vehicle's acceleration and speed, as well as commute time and distance traveled" and that "Allstate's 'Drivewise' program, by contrast, relies primarily on customers' smartphones. Drivewise measures vehicle speed, commute time, and the force experienced when braking").

one's smart life to draw inferences about risk and predict insurance rates to match that risk.[214]

Smart cars provide a helpful window into the interplay of direct digital proof and inferential habit evidence. For example, smart car data will become central to accident reconstruction cases and criminal incidents involving vehicles. Many times, the recordings will be useful direct evidence of what happened at the moment of the crash. But other times, the past habits of driving before the incident will be more relevant.

A fascinating case in Florida shows the potential power of this type of habit evidence.[215] A family sued Tesla after their son died in a fiery car accident. In an effort to show contributory negligence, Tesla introduced past car data showing that the driver routinely drove at high speeds and in a reckless manner.[216] Using collected past car data, Tesla demonstrated that the car was driven at ninety miles per hour on average in the days leading up to the crash.[217] The evidence—which could be characterized as digital habit evidence—was introduced through expert testimony in addition to direct evidence of the speed at the time of the crash.[218] This type of digital evidence bolstered Tesla's claim of contributory negligence and helped reduce Tesla's negligence to 1 percent.[219]

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214. Rick Swedloff details insurance companies' data gathering for the purpose of calculating risk:

> It is not hard, given the burgeoning interconnectivity of mundane, household objects like dishwashers, refrigerators, heating and cooling systems, and washing machines, to imagine that insurers could expand their data-gathering experiment into new lines. An insurer could find ways to harness information from these household objects to assess potential losses in a house. Similarly, a life insurer could use information gathered from smartphones, wearable health devices, or credit card statements to assess how often one exercises, goes to the gym, or purchases healthy foods to assess life expectancy.

Rick Swedloff, *The New Regulatory Imperative for Insurance*, 61 B.C. L. REV. 2031, 2063 (2020).

215. Riley v. Tesla, Inc., No. 20-CV-60517, 2022 WL 1486905, at *2 (S.D. Fla. May 11, 2022), *on reconsideration*, No. 20-CV-60517, 2022 WL 2341165 (S.D. Fla. June 29, 2022).

216. Harris, *supra* note 13.

217. *Id.*

218. The evidence came in through expert testimony, not via FRE 406. The exhibit introducing the expert report detailed the prior driving speeds. Report or Affidavit of James Edward Walker, Jr., P.E. at 28, Riley v. Tesla, Inc., No. 20-CV-60517, 2022 WL 1486905 (S.D. Fla. May 11, 2022), 2021 WL 3036521.

219. Malathi Nayak, *Tesla Crash Victim Was 99% to Blame for His Death, Jury Says*, BLOOMBERG (July 19, 2022, 11:26 AM), https://www.bloomberg.com/news/articles/2022-07-19/jury-finds-tesla-crash-victim-mostly-to-blame-for-his-death [https://perma.cc/4H6C-7P9F].

As another example, when jurors are judging the criminal culpability of a reckless driver who claims that they were speeding because of a need to rush to the hospital, a past habit of safe driving, observable through car data, will support the driver's claim. The direct digital evidence of the moment before the crash would not be helpful as it only shows the elevated speed. In addition, a prosecutor arguably would be able to keep out the past direct digital evidence under a relevance argument, as past safe driving is not relevant to the reckless crash at issue. But under a habit theory, the defense should be able to prove the habit of not driving recklessly to undercut the inference of recklessness.

At a second level of data collection, smart cars will soon be monitoring the outside world.[220] Some high-end cars already offer cameras and sensors for driving assistance, parking, and security.[221] In Tesla cars, these cameras are always on and thus can record a hit-and-run accident or an attempted theft.[222] Further, the promise of autonomous cars requires even more data collection.[223] To work as intended, the autonomous car will constantly communicate with the outside world through sensors and video, revealing its path through data.[224] In other words, driverless car systems will have to predict the

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220. Adrienne LaFrance emphasizes the privacy dangers of such data mining:

> This level of data collection is a natural extension of a driverless car's functionality. For self-driving cars to work, technologically speaking, an ocean of data has to flow into a lattice of sophisticated sensors. The car has to know where it is, where it's going, and be able to keep track of every other thing and creature on the road. Self-driving cars will rely on high-tech cameras and ultra-precise GPS data.

Adrienne LaFrance, *How Self-Driving Cars Will Threaten Privacy*, ATLANTIC (Mar. 21, 2016), www.theatlantic.com/technology/archive/2016/03/self-driving-cars-and-the-looming-privacy-apocalypse/474600 [https://perma.cc/TG3L-P76C].

221. Kate Fazzini & Lora Kolodny, *Tesla Cars Keep More Data Than You Think, Including This Video of a Crash That Totaled a Model 3*, CNBC (Mar. 29, 2019, 5:19 PM), https://cnb.cx/2U5U2mi [https://perma.cc/5SX8-YA7S].

222. Geoffrey A. Fowler, *My Car Was in a Hit and Run. Then I Learned It Recorded the Whole Thing*, WASH. POST (Feb. 27, 2020, 7:00 AM), www.washingtonpost.com/technology/2020/02/27/tesla-sentry-mode [https://perma.cc/5MKZ-7DSZ] (describing the eight cameras on his Tesla).

223. Halie B. Peacher, *Regulating Data Privacy of Connected Vehicles: How Automotive Giants Can Protect Themselves and Their Golden Goose*, 30 ALB. L.J. SCI. & TECH. 74, 78 (2020) ("Connected vehicles communicate in three different ways: vehicle-to-vehicle ('V2V'), vehicle-to-infrastructure ('V2I'), and Connected Vehicle Mobility Applications ('CVMAs').").

224. Trope & Smedinghoff, *supra* note 206, at 8 ("For autonomous cars to be safe, they must communicate with one another (especially about their respective position, speed, course, and intended maneuvers or turns). Their communications must be two-way."); Froomkin & Colangelo, *supra* note 210, at 199–200 (noting how connected cars do not "have to have any

habits of millions of drivers to teach the autonomous cars to drive in a safe and orderly manner.

In parallel development, external surveillance devices will watch cars drive and park and thus will monitor the people who use them.[225] City infrastructure, which can currently monitor open parking spaces, read license plates, and collect tolls, will grow in monitoring sophistication.[226] Traffic congestion, accidents, and construction will all be identified and avoided.[227] Smart streetlights will turn on as you drive, cameras will catch you speeding, and services like cheap gas or nearby restaurant deals will be advertised for your convenience.[228] Some of this digital infrastructure will be built to respond to individual trips and personal preferences, but others will be built around the habits of a population. Traffic patterns, road closures, and street light patterns will all be guided by predictive guesses from collected data.

The convenience apps on your phone already collect smart data.[229] In fact, while car data can show all the trips a person took, phone data and tracking apps can show what that person did in those locations. Whether it is cell phone signals, or apps, the tracking capabilities of data are staggering.[230] As the *New York Times* detailed, the digital

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autonomous capabilities" while "autonomous vehicles almost certainly will require the ability 'to collect, send, and receive different types of data, or will at least depend on some manner of mapped data (such as through GPS) for the vehicle to function autonomously, in addition to any connected features the car may have.'").

225. Ferguson, *Structural Sensor Surveillance*, *supra* note 19, at 55 (detailing surveillance technologies deployed in the built environment).

226. Janine S. Hiller & Jordan M. Blanke, *Smart Cities, Big Data, and the Resilience of Privacy*, 68 HASTINGS L.J. 309, 317–18 (2017) (discussing parking innovations in smart cities).

227. Colin Harrison & Ian Abbott Donnelly, *A Theory of Smart Cities* 3 (Proc. 55th Ann. Meeting Int'l Soc'y Sys. Scis., 2011) (explaining that "[a] road tolling system . . . provides large amounts of precise, 'real-time' information about the movement of vehicles through toll gates" and "[w]hen such patterns are then found in 'real-time' data, they provide a warning period that enables managers to adjust the traffic management system to prevent such congestion occurring").

228. Sarah Holder, *The Shadowy Side of LED Street Lights*, CITYLAB (Mar. 8, 2018, 10:44 AM), www.citylab.com/equity/2018/03/their-lights-were-watching-odd/554696 [https://perma.cc/C74K-RY5E].

229. Brill & Jones, *supra* note 6, at 1190–91 ("Your smartphones accumulate some of the same data and with it you can use your WiFi and GPS to track how far you walk, where you walk, how many steps you take, and how many stairs you climb, among other things.").

230. Michael Grothaus, *Google Tracks Your Movements Even if You've Turned Location History Off*, FAST CO. (Aug. 13, 2018), www.fastcompany.com/90217689/google-tracks-your-movements-even-if-youve-turned-location-history-off [https://perma.cc/Z7N7-9VNP].

signals of phones can be tracked back to identify individuals at particular homes and offices.[231]

Cars and location data have already played prominent roles in the development of constitutional criminal procedure. The GPS device attached to Antoine Jones's Jeep in *United States v. Jones* led the Supreme Court into a new way of thinking about long-term tracking as a search under the Fourth Amendment.[232] The cell-site location tracking of Timothy Carpenter as he went about robbing Radio Shacks led the Supreme Court to find a search in the acquisition of seven days' worth of cell phone records from Sprint PCS.[233] Both cases directly confronted the privacy and security harms of law enforcement collection of location data.[234] This trend will continue as direct data from phones and cars will be used as regularized proof in criminal cases. In addition, these same digital clues can be recharacterized as habit to show patterns of inculpatory or exculpatory actions in particular cases. If there is one thing that location data provides, it is the ability to visualize regular patterns of movement and repetitive activities about the various people engaged in the investigation or lawsuit.

4. *Habits at Work*. For many employees, work has always been a form of surveillance.[235] Punch cards, badges, billable hours, quotas, and a host of traditional technologies have been used to enforce productivity and monitor workers.[236] Modern digital tracking

231. Jennifer Valentino-Devries, Natasha Singer, Michael H. Keller & Aaron Krolik, *Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret*, N.Y. TIMES (Dec. 10, 2018), www.nytimes.com/interactive/2018/12/10/business/location-data-privacy-apps.html [https://perma.cc/UGN8-6ZZQ].

232. *See* United States v. Jones, 565 U.S. 400, 402–08 (2012).

233. Carpenter v. United States, 138 S. Ct. 2206, 2212, 2217 (2018).

234. *See* Paul Ohm, *The Many Revolutions of Carpenter*, 32 HARV. J.L. & TECH. 357, 358 (2019) ("The most obvious revolution is the case's basic holding—information about the location of cell phone customers held by cell phone providers is now protected by the Fourth Amendment, at least when the police seek seven days or more of such information.").

235. Matthew T. Bodie, *Workplace Freakonomics*, 14 I/S: J.L. & POL'Y FOR INFO. SOC'Y 37, 45 (2017) ("Employers have long monitored employee workplace behavior through supervisors and fellow employees. New forms of electronic monitoring have significantly expanded the ability to observe various aspects of employee activity."); Ajunwa et al., *supra* note 10, at 737 ("Ubiquitous employer surveillance of workers has a long and rich history as a defining characteristic of workplace power dynamics, including the de facto abrogation of almost any substantive legal restraints on its use.").

236. Ajunwa et al., *supra* note 10, at 742–43 ("Punch clocks have given way to thumb scans, key cards may soon give way to Radio Frequency Identity (RFID) tags, and internet browser

technologies provide an easier and more granular window into work habits.[237] Now, instead of just measuring the number of hours an employee spends at their desk, employers can measure the number of keystrokes[238] or calls or even the tone of an employee's voice.[239] Large retail warehouses run by larger companies such as Amazon have sophisticated productivity metrics based on data collection.[240] Delivery services like FedEx are not just tracking their packages, but their drivers.[241] Hospitals can track nurses through RFID chips implanted in their badges,[242] construction managers can track labor,[243] and assembly lines are embedding tracking sensors in many manufacturing plants.[244]

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histories are often scrutinized closely. Employers log keystrokes, interested in capturing not only when their employees use private services . . . but also what they publish there.").

237. McKay Cunningham discusses how employers utilize employee badges to surveil employees:

> Employee badges are no longer limited to identification and building access. They record and transmit when the employee arrives and leaves, often tracking the employee long after the workday ends. Newer iterations of employee badges record audio as well, allowing employers to record everything that is said and to whom. Tone of voice and rapidity of speech can affect an employer's evaluation of the employee's productivity.

Cunningham, *supra* note 9; *see also* Antigone Peyton, *The Connected State of Things: A Lawyer's Survival Guide in an Internet of Things World*, 24 CATH. U. J.L. & TECH. 369, 370 (2016) ("IoT also involves devices sold in a business-to-business context and machine-to-machine communications that enable businesses to track inventory, currency, functionality, and efficiency.").

238. Bodie, *supra* note 235 ("Computer monitoring software can keep track of all activity on a particular device, including websites visited, keystrokes and interactions with other devices.").

239. Peppet, *supra* note 3, at 113 ("The Bank of America, for example, has used sensor badges to record call-center employees' movements and tone of voice throughout the day.").

240. Colin Lecher, *How Amazon Automatically Tracks and Fires Warehouse Workers for 'Productivity*,' VERGE (Apr. 25, 2019, 12:06 PM), https://www.theverge.com/2019/4/25/18516004/amazon-warehouse-fulfillment-centers-productivity-firing-terminations [https://perma.cc/9TXF-D66B].

241. Fort et al., *supra* note 199, at 145 (quoting a FedEx executive stating that "[w]earable technology is already having a significant impact on FedEx team members who are involved with package sorting and pickup and delivery" (quoting *Q&A with Mike Glen, Fedex Services*, ACCESS (Nov. 2013), http://access.van.fedex.com/qa-mike-glenn-fedex-services [https://perma.cc/7CXE-PZJ6])).

242. Jill Schachner Chanen, *The Boss Is Watching and Employees Are Finding They Have Fewer Places To Hide*, ABA J., Jan. 2008, at 53 (describing RFID chips in nurses' badges).

243. Daniel S. Brennan, *The Internet of Things in Construction: Opportunity, Risk and Insurance Considerations*, 13 J. AM. COLL. CONSTR. LAWS. 3 ("Time tracking software and apps installed on portable devices, such as smartphones and tablets, enable contractors to track location and hours worked by its labor forces.").

244. Ben Rossi, *The Internet of Things Business Process Revolution*, INFO. AGE (Sept. 10, 2014), www.information-age.com/internet-things-business-process-revolution-123458453 [https://perma.cc/DNX7-5LAF]; Peyton, *supra* note 237 ("IoT also involves devices sold in a business-to-

Even the gig economy thrives on digital tracking of workers and deliveries.[245] Whether offered in the name of "workplace wellness"[246] or protecting corporate interests,[247] the result is the quantification of work activities through data.[248]

The result is that behaviors and patterns of routine activities can now be studied in greater detail and potentially spur factual development in tort and criminal cases.[249] A warehouse worker suing their employer for unsafe conditions may have direct proof of extended

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business context and machine-to-machine communications that enable businesses to track inventory, currency, functionality, and efficiency.").

245. *See* Danya Shakfeh, *New Employment Laws for A New Generation?*, 32 DCBA BRIEF 8, 8–9 (2019) ("A gig economy is defined as a labor market that is characterized by the prevalence of short-term contracts or freelance work as opposed to permanent jobs."); *see also* Tiffany C. Li, *Privacy in Pandemic: Law, Technology, and Public Health in the COVID-19 Crisis*, 52 LOY. U. CHI. L.J. 767, 788 (2021) ("Gig-economy workers already have few privacy protections and are often subject to surveillance and data collection and tracking from companies.").

246. Matthew T. Bodie discusses how employee surveillance is justified in the name of worker wellness:

> Workplace wellness programs have become a routine part of the palette of health-related offerings from employers. The central idea is to provide incentives to employees to improve their health along certain metrics. Financial or social rewards are provided to workers who get a flu vaccine, lose weight, or quit smoking. Because the employer provides for employee health insurance, these programs are seen as win-win: both the worker and the company share in the cost savings provided by the worker's improved health.

Bodie, *supra* note 235, at 46.

247. Jeffrey M. Hirsch, *Future Work*, 2020 U. ILL. L. REV. 889, 928 ("Many employers are already monitoring workers extensively in an attempt to crack down on shirking, protect trade secrets, stop harassment, and other reasons.").

248. *There Will Be Little Privacy in the Workplace of the Future*, ECONOMIST (Mar. 28, 2018), www.economist.com/special-report/2018/03/28/there-will-be-little-privacy-in-the-workplace-of-the-future [https://perma.cc/9AFK-BPWN]; Richard M. Reice, *Wearables in the Workplace—A New Frontier*, BLOOMBERG L. (May 24, 2018, 5:40 AM), https://news.bloomberglaw.com/daily-labor-report/wearables-in-the-workplacea-new-frontier [https://perma.cc/M792-9XQC]; Rebecca Greenfield, *New Office Sensors Know When You Leave Your Desk*, BLOOMBERG (Feb. 14, 2017, 6:30 AM), www.bloomberg.com/news/articles/2017-02-14/new-office-sensors-know-when-you-leave-your-desk [https://perma.cc/EFN6-JQCR]; Ryan Derousseau, *The Tech that Tracks Your Movements at Work*, BBC (June 14, 2017), www.bbc.com/capital/story/20170613-the-tech-that-tracks-your-movements-at-work [https://perma.cc/YUE2-NM5A]; Olivia Solon, *Big Brother Isn't Just Watching: Workplace Surveillance Can Track Your Every Move*, GUARDIAN (Nov. 6, 2017, 3:00 PM), www.theguardian.com/world/2017/nov/06/workplace-surveillance-big-brother-technology [https://perma.cc/LJ2J-LRZ7].

249. Bodie elaborates on how rampant surveillance enables the study of human behavior:

> We now know a lot more about patterns of human behaviors and the relationships within those behaviors, and employment is no exception. Companies have long analyzed their workers in order to reward their most talented employees, punish slackers, and increase everyone's productivity. However, data analytics—often called "people analytics" in this context—offers new opportunities to reveal heretofore undiscovered insights about job performance.

Bodie, *supra* note 235, at 37.

hours, unreasonable work requirements, or the cause of repetitive injuries. A tort plaintiff suing a car manufacturer for a defective, unresponsive airbag may well have data to prove the delayed deployment. Financial and fraud crimes will be built around digital transfers and patterns dutifully recorded in the ordinary course of business records. In short, all of the old examples of custom or routine practice will be observable in data and are only a discovery request, subpoena, or warrant away from court.

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The above description of how Internet of Things devices will reveal clues about daily life is necessarily incomplete. Every day, new technologies are being created and embedded into the fabric and design of modern life. In those areas covered by a digital web, we can collect fragmentary clues about who, what, where, when, and how something happened—the very questions at issue in civil and criminal trials. Of course, knowing more about ourselves does not necessarily result in an improvement in life, and it may well create harmful impacts around surveillance, social control, and the commodifying of personal activities. But, whether unwelcome or not, the data is being created and will be used when the question of "what happened" is raised in trial. As the next Section discusses, habit evidence offers the legal pathway to admit this wealth of personal data in trial.

III. DIGITAL HABIT AS FACT

Part I examined the background rules around habit evidence, concluding that FRE 406 offers few limitations and broad potential applicability. Part II examined how data from smart devices and the Internet of Things reveals new patterns of behavior and allows predictions about habit, which, when connected to a broad reading of FRE 406, will open the door for greater use. Part III examines how digital habits collected by smart devices may reshape evidence theory and legal practice.

This Part begins by examining the theory of habit evidence, showing how smart data supports the intuition behind the traditional rule. Data collected from the Internet of Things offers strong support for the logic behind both the probabilistic and psychological theories

of habit evidence.[250] Second, this Part looks at how digital habit evidence will be used in civil and criminal cases. Digital habit evidence will impact definitions of relevance, expand discovery, change pretrial litigation tactics, and open the door for different types of corroborative proof.[251] Finally, this Part offers some thoughts about how an expanded digital habit evidence doctrine might complicate existing theories around character evidence and prior bad acts.[252]

A. Reexamining Digital Habit Theory

Digital habit evidence offers the opportunity to test the instincts and assumptions behind FRE 406 and common law cases. Interestingly, the growth of digital habit evidence may help prove a heretofore rather amorphous and untested theory about human behavior. Although not without its complications and gaps, data can help justify an expanded habit doctrine. At the same time, many of the criticisms of predictive analytics arising from algorithmic monitoring may infect evidence law as it becomes more reliant on data.

To begin, it is important to recognize that the opportunities around quantification are relatively new to evidence theory.[253] Evidence law has long been a creature of tradition and practice, not hard data. After all, the Federal Rules of Evidence emerged in the 1970s from the common law and hundreds of years of trial practice without any reliance on empirical data.[254] Rules around hearsay, authentication, and best evidence, for example, were adopted without a requirement of data-driven proof. More specifically, the Federal Rules allow excited utterances into evidence under FRE 803(2), not because we have data that most excited utterances are, in fact, reliable,

250. *See supra* Part I.A.2.

251. *See infra* Part III.B.

252. *See infra* Part III.C.

253. In recent years, scholars have filled this gap with interesting data-driven and empirical work on evidence law. *See, e.g.*, Jeffrey Bellin, *The Silence Penalty*, 103 IOWA L. REV. 395, 403 (2018) (detailing an empirical study that evaluates how defendants are penalized after testifying under Rule 609); Justin Sevier, *Legitimizing Character Evidence*, 68 EMORY L.J. 441, 457 (2019) (discussing psychological studies on character evidence).

254. Empirical, data-driven studies were not a central part of the FRE or its advisory committee's notes. G. Alexander Nunn, *The Living Rules of Evidence*, 170 U. PA. L. REV. 937, 983 (2022) ("[S]cholars have long noted that many of the Rules are anachronistic. Folk psychology and outdated cultural claims serve as the predicate for admitting many unreliable pieces of evidence. . . . [F]or instance, Rule 803(2)'s excited utterance exception stands strong despite multiple studies questioning its empirical basis.").

but because of human intuition that such statements should be reliable.[255] Similarly, the Federal Rules allow witnesses to identify a voice under FRE 901(b)(5) not because we have data that such authentication is accurate, but because we assume based on personal experience that humans can usually identify familiar voices.[256] Of course, the Rules of Evidence could be empirically tested, but there has not been a sustained push to challenge these traditional precepts or test our evidentiary assumptions.[257]

Data collected by the Internet of Things offers the chance to test the traditional assumptions behind habit evidence. This Section examines how smart data clarifies the intuition behind the probabilistic and psychological theories of habit and adds some complexity around the role data-driven predictions should play in trial.

1. *Testing Probabilistic Habit Evidence Theory*. At a basic level, digital clues from our daily lives can test the accuracy of the probabilistic theory of habit. If the question is whether a driver habitually drives the speed limit down a particular street (in order to prove her careful driving right around the time of an accident), we can look to see whether this fact is true based on a probabilistic analysis. The driver's car, smart phone, or other digital tracking device can tell us that over the last one hundred times, the driver maintained the legal speed limit 59 percent of the time or 95 percent of the time or 2 percent of the time.[258] As theory, we can confirm the traditional, human testimony that the driver has a habit of not speeding on that street with numbers behind our probabilistic intuition. While we might not know

255. *See* Christopher B. Mueller, *Post-Modern Hearsay Reform: The Importance of Complexity*, 76 MINN. L. REV. 367, 378 (1992) (describing the lack of empirical data on hearsay exceptions); *see also* Michael L. Seigel, *Rationalizing Hearsay: A Proposal for a Best Evidence Hearsay Rule*, 72 B.U. L. REV. 893, 947 (1992) (summarizing research to argue that the exception for excited utterances in hearsay is "flatly contradicted by empirical evidence developed over the last seventy years"); *cf.* Douglas D. MacFarland, *Present Sense Impressions Cannot Live in the Past*, 28 FLA. ST. U. L. REV. 907, 914 (2001) (discussing tests that show present sense impressions are less accurate than assumed).

256. The lack of empirical data about voice authentication is typical of the lack of empirical data about most of the Federal Rules of Evidence. The Rules themselves built off the common law and trial practice and were not subjected to testing or data-driven proof before adoption. Nunn, *supra* note 254, at 942 ("[T]he psychology-based claims underlying Rule 803(1)'s present sense impression exception, Rule 803(2)'s excited utterance exception, and Rule 804(b)(2)'s dying declaration exception face withering empirical challenges.").

257. Perhaps there will be a future law review article on data-driven, empirically tested evidence rules.

258. Obtaining this data would first require a relevance argument, which Part III discusses.

the speed on the date of the crash if the car sensors malfunction or are destroyed (direct evidence), we have a probable predictive assessment of the speed based on past conduct (indirect evidence).

In terms of numbers, litigants can put rough percentages behind the frequency of habits. Habit will become quantified as fact. For example, a litigant can offer evidence of their own habit of leaving the house before 7:00 a.m. by showing that 94 percent of Wednesdays, they left the house (smart doorbell) and got into their car (smart car) before 7:00 a.m. Such evidence would likely be far more convincing than a neighbor's testimony that the litigant had a habit of leaving for work early every Wednesday. The evidence might also be more readily admissible than direct digital evidence. If, for example, the question is whether the litigant was out of the house at the time of the alleged crime, their past actions of leaving a house at a certain time are not necessarily relevant. But under a habit theory, the same digital clues might establish a pattern relevant to their alibi or culpability.

The demonstrated reality that certain acts repeat often enough to be considered habit evidence confirms the common law intuition behind the doctrine. Habits, captured by data, can become testable. This alone is an important insight. While traditionally somewhat vague and unmoored in practice, some digital habits can now be quantified and thus useful to prove a point in trial.

That said, the theory of habit is not without its complications. While smart data will offer the ability to confirm the theory underlying probabilistic habit evidence, the availability of data raises hard line-drawing questions. For example, how many times does one need to act to become legally significant? What is the probability that we care about? Is it 51 percent? Or something far higher? The *Whittemore* case's four times, cited in the Advisory Committee Notes, is clearly a very low bar in terms of raw numbers.[259] Would driving four times following the speed limit be enough to prove habit? Probably not. But forty or four hundred times? Or a percentage of the time? Probably, but without new, digitally aware updates to old evidence rules, the answers will remain unclear.

Equally hard are questions about the granularity and precision of the quantifiable data. Precise data is a double-edged sword, allowing litigants to distinguish similar patterns as being too different or imprecise to rely upon in the case at hand. For example, in our driving

259. *See supra* note 92 and accompanying text (discussing the facts of *Whittemore*).

hypothetical, what if the driving data does not involve the same street, but other nearby streets? Is that data relevant to the question of the habit of driving on a particular street or a particular part of the street? Does time of day, or weather, or time of year matter? In traditional habit evidence, the lack of specificity was excused because knowing precise levels of data was difficult, if not impossible.[260] But with granular car data, we can drill down to the particular street, location, day, and even time.[261] As might be obvious to those familiar with litigation, the more precise the data, the easier it would be to distinguish the past data from the present question.

Some might argue that the granularity of data will destroy the validity of habit evidence because when looked at for precise matches, data might not help litigants prove a consistent habit. Perhaps the pattern of a person leaving the home before 7:00 a.m. on Wednesdays turns out to be a reality only a few times a month. Or if rephrased as whether someone left the home at 6:45 a.m., the vagaries of leaving at 6:42 a.m. and 6:47 a.m. will prove too inexact to be a habit.

The response, of course, is that habit has never required that level of precision.[262] If we accept the broad and rather open definition of FRE 406 and apply it to the digital world, this type of inexactness will be forgiven. Notwithstanding the practical tensions of this quantification debate, as a matter of evidence theory, digital evidence will let us test, and likely confirm, the probabilistic theory of habit.

2. *Testing the Psychological Theory of Habit*. In addition to confirming the logic behind the probabilistic theory of habit, new data trails also support the regularity behind the psychological theory of habit. Again, the psychological theory of habit focuses on the automatic, unthinking, and nonvolitional response to specific stimuli.[263] Although smart data cannot prove the automatic nature of the reaction, it can identify causal relationships between the stimulus that

260. *See supra* Part I (discussing the common law history of habit).

261. *See* Imke Reimers & Benjamin R. Shiller, *The Impacts of Telematics on Competition and Consumer Behavior in Insurance*, 62 J.L. & ECON. 613, 614 (2019) (describing automotive "telematics devices that, when installed in an insured's car, collect proprietary data on risky behaviors such as hard braking, speeding, and late-night driving").

262. *See supra* notes 36, 85–86 (discussing the flexible admission rules around habit in the common law and the Federal Rules).

263. *See supra* notes 40, 42 (discussing the psychological theory of habit).

creates an automatic reaction and the response that confirms the immediate timing between the two.

For example, every day I am confronted with socks. I have feet. I must put my socks on my feet. In the ordinary course, I put on my socks, first left then right, the same way each time. I have probably repeated this pattern well over twenty thousand times in my life. I do not think about it. It is both automatic and regularized and happens immediately when I pick up the socks. It is classic habit that, if quantified via "smart socks,"[264] could become demonstrable fact.

Whereas the probabilistic theory measures the number of times an act occurs, such as my daily pattern of putting on socks, the psychological theory looks at the stimulus and its causal and temporal relationship to my response. For example, when faced with socks, the left one goes on first and is immediately followed by the right. What is being measured in data is the causal relationship between stimulus (socks) and specific reaction (first left, then right).

The theoretical point is that the common law intuitions, which allowed habit evidence to be introduced in trial through a psychological theory, can be proved in fact through data. Using data trails, we can visualize and predict the micropatterns of daily life.[265] As a general rule, habits can be identified when a familiar contextual pattern of action (for example, preparing breakfast in the morning) overlaps with a more specific triggering pattern of activity (opening the dishwasher) and produces a predictable pattern of responsive action (starting the coffee maker). I could tell you that the first thing I do ("habitually") after I open the dishwasher in the morning is start a pot of coffee, but a smart dishwasher and smart coffee pot could tell you the same thing through data and be far more precise about the timing, regularity, and immediacy.

Notice that the context of the pattern matters. Most weekdays the data would show the dishwasher opens during breakfast time and is

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264. *See* Zixuan Zhang, Tianyiyi He, Minglu Zhu, Zhongda Sun, Qiongfeng Shi, Jianxiong Zhu, Bowei Dong, Mehmet Rasit Yuce & Chengkuo Lee, *Deep Learning-Enabled Triboelectric Smart Socks for IoT-Based Gait Analysis and VR Applications*, NPJ FLEXIBLE ELECTRONICS, 2020, at 2–3; *see also* Meg Leta Jones, *Privacy Without Screens & the Internet of Other People's Things*, 51 IDAHO L. REV. 639, 643 (2019) ("Smart socks, made by Heapsylon are infused with textile pressure sensors paired with a set of proprietary electronics that not only accurately track steps, speed, calories, altitude gain, environmental temperature, and distance, but also track cadence, foot landing technique, center of balance, and weight distribution on the foot . . . .").

265. *See supra* Part II.

followed by the brewing of coffee. But there are other times during the day when the dishwasher runs (after a holiday meal, a summer party) and there is no corresponding pot of coffee. The context of the morning matters. Notice also that while the dishwasher and coffee maker are correlated as connected (that is, they both likely happen on the vast majority of days), they are wholly separate activities. A pattern can be identified through sensor data, but it might be dependent on other things such as the availability of coffee, electricity, or a new caffeine-free lifestyle.[266] As Part I discusses, habit evidence has remained remarkably unconcerned with the counterfactual possibilities, looking instead to patterns of what has happened as opposed to what could happen or did not happen.[267]

Studying the patterns of a smart kitchen might be evidence that in the context of a particular morning, the fact that the dishwasher opened suggests that coffee was being brewed at a certain time. If, in a criminal case, the argument were that the suspected law professor could not have committed the murder across town because the digital trails suggested the professor was having a morning cup of coffee, as was his habit, the digital trails might be good evidence to support this alibi. Or if the crime happened inside the home, the pattern would be good evidence to suggest presence and opportunity in the kitchen. Because habit evidence is admissible without concern to whether other evidence also exists, this type of evidence will be admissible under FRE 406.[268]

There are numerous questions about admitting habit evidence under a psychological theory. Like with the probabilistic theory, a deep question goes into the granularity of data and how more data makes it easier to distinguish and find differences. For example, the granularity issue is raised around the specificity of the external stimulus and timing of an automatic reaction. Both specificity and timing can be questioned when you get deep into the digital weeds. If the question in a tort suit involves whether a driver signaled a right turn before a car accident, the traditional habit answer would be to adduce testimony that the driver always habitually signaled before turning. In a smart data case, one now needs two points of data: first, information about the stimulus (the approaching turn) and, second, the timing of the reaction (the

266. Purely a hypothetical.

267. *See supra* Part I.C.

268. As Part I.B discusses, digital trails can and will be used as direct, corroborative, and circumstantial evidence of contested facts.

signaling). Working backward, you could figure out from existing car data whether each time someone turned, they also had signaled at some time beforehand. A question, of course, would be whether the timing was almost immediate, or delayed, or inconsistent, or something else. A smart car would provide this data proving or disproving the psychological claim that this is an automatic, unthinking reaction. But lines will have to be drawn. How automatic is automatic? What happens if there are gaps or inconsistent reactions? These are unanswered questions, but they are questions that do not undermine the general theory that some automated reactions are the kinds of psychological responses that evidence has long allowed. Not all digital clues will be allowed as habit, but many will be admissible.

3. *Predictive Habit Evidence*. Although largely unacknowledged in the Federal Rules, the theory behind habit evidence is intertwined with prediction. Courts admit a habit into evidence because a past habit makes it more likely that in the present case the same habit occurred.[269] Or, in other words, the predictive accuracy of habits is good enough to allow past facts to prove a present, contested fact.[270]

This is the same logic behind many predictive algorithms that nudge us through digital prompts.[271] The smartwatch that tells you to get up and breathe, or the alarm prompt that knows you get up at 6:30 a.m. every day, is based on a generic algorithm applied to past personal habit, suggesting the likelihood of a similar future action. The

269. *See* Marshall et al., *supra* note 27, at 10 ("The greater specificity of habit evidence increases its predictive value, thereby increasing the jury's ability to assess the weight of this evidence and supporting its admissibility.").

270. As one court recognized, while habit is usually a predictive judgment to prove a past fact, it might on occasion also be useful to prove a future predicted fact. *See* Williams v. Sec. Nat'l Bank of Sioux City, Iowa, 358 F. Supp. 2d 782, 813 (N.D. Iowa 2005) ("Rule 406 provides that habit evidence may be used 'to prove that the conduct of the person . . . on a particular occasion was in conformity with the habit.' . . . Thus, the Rule uses 'habit' evidence to prove what someone *actually did*." (citing FED. R. EVID. 406)); *see id.* at 814 ("This court concludes that evidence of a 'habit' would, in most circumstances, provide sufficient factual basis for a reasonable inference about *what someone would have done* in like circumstances.").

271. *See* Michael Selmi, *Algorithms, Discrimination and the Law*, 82 OHIO ST. L.J. 611, 614–15 (2021) ("Algorithms have infiltrated many parts of our life, especially in consumer decisions with various nudges by Spotify, Amazon or Netflix designed to prompt us to buy more things and ideally to buy things that we may not have previously considered.").

predictive algorithm, of course, is created based on the patterns of others but applied to your personal patterns.[272]

The role of algorithms raises issues that must be flagged about the reliance of predictive habit evidence in court. The first concern involves the mixture of generic and personal predictions. As has been determined in a host of other predictive systems, these computer programs can be biased in terms of race, gender, age, economic status, and disability.[273] The generalizations used to norm the algorithm have largely been created by and for a privileged set of technology creators that have repeatedly ignored or excluded those not in that privileged group.[274] Thus, reliance on digital habits mediated by algorithmic

272. *See* Hilary J. Allen, *Driverless Finance*, 10 HARV. BUS. L. REV. 157, 191 (2020) ("For example, a machine learning algorithm might learn from humans that it should consistently 'nudge' customers into financial products and services that generate higher margins for the algorithm's proprietor by obscuring the true costs and risks of a product, potentially contributing to a bubble."). *See generally* Michal S. Gal, *Algorithmic Challenges to Autonomous Choice*, 25 MICH. TELECOMM. & TECH. L. REV. 59 (2018) (discussing how autonomous algorithmic assistants can replace human choice and how they affect laws designed to apply to choices by humans).

273. *See* Anupam Chander, *The Racist Algorithm?*, 115 MICH. L. REV. 1023, 1032 (2017) ("Despite these efforts, sentencing based on ranges determined by algorithm did not end discrimination . . . ."); Andrew D. Selbst, *Disparate Impact in Big Data Policing*, 52 GA. L. REV. 109, 120–23 (2017) (discussing racially-biased outcomes made by predictive technologies); Amitai Etzioni & Oren Etzioni, *Keeping AI Legal*, 19 VAND. J. ENT. & TECH. L. 133, 134–35 (2016) ("Google faced allegations that its search engine discriminated against women by showing ads for well-paying jobs to men more frequently than to women . . . ."); James A. Allen, *The Color of Algorithms: An Analysis and Proposed Research Agenda for Deterring Algorithmic Redlining*, 46 FORDHAM URB. L.J. 219, 230–53 (2019) (describing housing discrimination caused by algorithms); Haley Moss, *Screened Out Onscreen: Disability Discrimination, Hiring Bias, and Artificial Intelligence*, 98 DENV. L. REV. 775, 791–92 (2021) (discussing whether machine learning and artificial intelligence causes bias against individuals with disabilities); *see also* CATHY O'NEIL, WEAPONS OF MATH DESTRUCTION: HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY 3 (2016) ("[Predictive] models encode[] human prejudice, misunderstanding, and bias . . . ."); FRANK PASQUALE, THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION 101–39 (2015) (detailing economic and other discrimination through algorithmic and computerized data in the financial sector). *See generally* VIRGINIA EUBANKS, AUTOMATING INEQUALITY: HOW HIGH-TECH TOOLS PROFILE, POLICE, AND PUNISH THE POOR (2017) (detailing bias in high-tech tools against the poor).

274. *See* Jonas Lerman, *Big Data and Its Exclusions*, 66 STAN. L. REV. ONLINE 55, 57 (2013) ("But there is another type of error that can infect datasets, too: the nonrandom, systemic omission of people who live on big data's margins, whether due to poverty, geography, or lifestyle, and whose lives are less 'datafied' than the general population's."); Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CALIF. L. REV. 671, 684 (2016) (discussing "the systematic disadvantage that members of protected classes may suffer from being miscounted and, as a result, misrepresented in the evidence base").

prompts deserves extra scrutiny as it might be impacted by bias inherent in the code.[275]

A second, related concern involves the role of technology in creating the habit. In other words, sometimes the response arises from a technological prompt and not the person themselves. For example, the fitness watch that prompts wearers to stand up, breathe, or walk is not just recording an act but prompting an act. The question is whether these actions are properly considered individualized human habits when acted upon, or if they should be seen as human responses to digital prompts (and whether that makes any difference). The automatic response to a stimulus may be measurable, but under a probabilistic theory, is it fair to consider this your personal habit when an algorithm mediated the action? Or in other words, if the stimulus is not your personal, psychological response alone, is it fair to consider your automatic response a personal habit (under a psychological theory)?

Similar questions arise in the workplace, where digital checklists and other standardized requirements create and sometimes require business habits and routine practices to be followed. For example, airline pilots, surgeons, and other medical professionals routinely follow standardized checklists to ensure safety.[276] Factory workers, warehouse workers, and delivery professionals routinely are monitored for productivity.[277] Employers mandate these customary habits, which are presumably followed for productivity, efficiency, or safety purposes. The question is whether they should count as routine habits or customs because they are imposed as a condition of employment.

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275. *See generally* RUHA BENJAMIN, RACE AFTER TECHNOLOGY: ABOLITIONIST TOOLS FOR THE NEW JIM CODE (2019) (describing bias in the criminal justice system's embrace of new surveillance technology).

276. Jeanine Blackett Lutzenhiser, *An Open Courts Checklist: Clarifying Washington's Public Trial and Public Access Jurisprudence*, 87 WASH. L. REV. 1203, 1235 (2012) ("For years, pilots and medical professionals have used deceptively simple checklists to manage routine practices in increasingly complex areas. These checklists help prevent the overlooking of routine but crucial matters that might get lost amidst the strain of more pressing events." (citing ATUL GAWANDE, THE CHECKLIST MANIFESTO: HOW TO GET THINGS RIGHT (2010))).

277. *See, e.g.*, Jeffrey M. Hirsch, *Future Work*, 2020 U. ILL. L. REV. 889, 908 (discussing the automation of warehouses); Michele Estrin Gilman, *The Class Differential in Privacy Law*, 77 BROOK. L. REV. 1389, 1403 (2012) ("Many low-wage employers use multiple methods to control their workers. For instance, a study of workers in the fast food and grocery industries found extensive forms of surveillance . . . .").

Despite these real concerns, the admissibility of the evidence might not turn on whether the stimulus was driven by human action, business practice, or a generalized algorithmic prompt. The broad rule of habit evidence probably allows such technology-mediated automated responses to stimuli to be admissible as a predictive habit. In a digitally mediated world, habits are shaped by technology but are still the things we do in a regular, automatic way. As long as litigants can show that pattern, the logic of habit evidence admissibility holds.

A final concern is whether predictions should ever be allowed to substitute as evidence. We might be quite reluctant to allow predictive guesses, stripped from the term "habit," to substitute for proof.[278] If digital habit is really just a prediction of possible future activity, some of our faith in this form of proof might erode. As other scholars have well canvassed, there exists a real danger when lawyers substitute predictions for proof in sentencing,[279] in pretrial risk determinations,[280] and when introducing statistical evidence in trial.[281] Predictions are by definition not always accurate and many times not particularized to the individual, having been based on assumptions of other similarly situated people.[282] Allowing that form of evidence to be used as fact may be morally and legally unwise. Some courts may study the underlying theory of habit and recognize that digital habit evidence goes too far because it relies too much on prediction.

B. Reshaping Admissible Digital Evidence

The combination of a largely undefined evidentiary rule and the limitless supply of digital clues could revolutionize trial practice. Habit

278. *See* Marshall et al., *supra* note 27, at 30 ("[T]he assumption that uniformities of the past will likely repeat in the future is enormous. Reliance on such an assumption for the purpose of predicting unobserved behavior is dangerously unreliable, especially if the past pattern of observed behavior is not a representative sampling . . . .").

279. *See, e.g.*, Sonja B. Starr, *Evidence-Based Sentencing and the Scientific Rationalization of Discrimination*, 66 STAN. L. REV. 803, 837 (2014) (critiquing the predictive validity of evidence-based sentencing systems that use discriminatory past facts to inform future sentences).

280. John Logan Koepke & David G. Robinson, *Danger Ahead: Risk Assessment and the Future of Bail Reform*, 93 WASH. L. REV. 1725, 1756 (2018) (detailing the danger of pretrial risk determinations based on past data).

281. David Enoch & Talia Fisher, *Sense and "Sensitivity": Epistemic and Instrumental Approaches to Statistical Evidence*, 67 STAN. L. REV. 557, 596 (2015) ("With the exception of DNA evidence, the use of statistical evidence for conviction purposes is extremely uncommon and very controversial.").

282. *See* Starr, *supra* note 279 (describing how evidence-based sentencing appears likely to disproportionately burden those belonging to certain demographic groups).

evidence may emerge from its relative dormancy into a prominent and preferred form of proof. This Section explores how digital habit evidence expands the scope of relevance, bolsters direct evidence, broadens discovery, reshapes litigation defenses, and encourages newly available sources of aggregate digital proof.

1. *Reimagining Relevance*. Digital habit evidence expands the scope of relevance.[283] Because habit evidence involves past actions admissible for a current unrelated event, the timeframe for relevant information about a person or event necessarily expands. Digital habit evidence, thus, will broaden the understanding of relevant evidence in many cases.

For example, in a car accident tort case, the relevant facts are traditionally cabined more or less to the moment of the accident and likely include the car's speed, location, and braking. In general, courts want to focus on facts and acts, choosing to avoid distracting details about past acts, inferences about character, or other details tangential to figuring out what happened. Information about driving patterns far afield from the incident is generally deemed irrelevant to resolving negligence. This reasoning makes sense: a normally super careful driver can be at fault in any given accident, just as a super reckless driver might not have caused a particular accident. Traditional habit evidence can occasionally fill in the gaps without better evidence. For example, a witness could testify about a driver's habit for always driving the speed limit on a certain stretch of highway.[284] But in general, the focus is on the facts of the accident, not facts about things unrelated to that moment in time.

However, in a world that has embraced an expanded vision of digital habit evidence, the scope of relevance broadens past the

283. *See* United States v. McCoy, 517 F.2d 41, 43–44 (7th Cir. 1975) ("Relevant evidence is defined in Rule 401 of the Federal Rules of Evidence to include all 'evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.'"). All evidence must pass a Rule 401 threshold test for relevance to be admissible. *See, e.g.*, Jerry Bennett Masonry, Inc. v. Crossland Const. Co., 171 S.W.3d 81, 98 (Mo. Ct. App. 2005) ("To be admissible evidence must be relevant, both logically and legally."). Rule 406 clarifies that habit evidence is a category of recognized relevant evidence. *See, e.g.*, Zempel v. Slater, 182 S.W.3d 609, 617 (Mo. Ct. App. 2005) ("Habit evidence 'is relevant to prove that the conduct of the person . . . on a particular occasion was in conformity with the habit or routine practice.'" (citations omitted)).

284. *See supra* Part I.B (discussing traditional examples of habit evidence, including testimonial evidence about habits).

moment of the accident. As discussed, the data about a smart car (collected through the black box in the car, third party data apps, or even smart phone data) will provide a clear picture of the type of drivers involved in the accident.[285] We will know what kind of drivers they are, not just what happened on a particular date. A wealth of historical information will exist about driving, some of which might relate to the same road, same driving patterns, or past near-misses.[286] This background driving data would then become corroborative habit evidence and potentially admissible, even though it has nothing to do with the particular accident. If you accept the arguments in Part I, that habit evidence under FRE 406 has few definitional limits, no corroboration requirements, and no concern about whether it is redundant to other evidence, the only limitation to admitting habitual driving patterns is the creativity of the litigants and tolerance of the judge. As long as a lawyer can come up with a habit that might be relevant about driving, that smart data will be considered relevant.

Note that two things have changed. First, the world of the Internet of Things has given us the capability to collect information that can easily be recharacterized as habit to prove a particular point. Second, a reimagined digital habit doctrine allows this data to be admitted under FRE 406 when it likely would not be admitted as direct evidence because past acts and patterns are not necessarily relevant to the current case. In a pre-Internet of Things world, the Rules might have allowed this type of information as traditional habit (if, for example, there were a passenger who drove everywhere with the driver and could testify in detail about driving habits), but with recorded smart data, every car now has that metaphorical passenger.

2. *Bolstering Direct Evidence*. Building off an expanded conception of relevance will be a related, expanded use of indirect digital evidence to bolster direct digital evidence. Remember, data from smart devices creates two forms of evidence. First, Internet of Things data provides *direct evidence*—for example, data on how fast a car was driving. This type of direct digital evidence will be the dominant form of trial evidence in the coming years. It presents evidentiary challenges for admissibility—authentication, relevance, and expert qualification—but is not anything different in kind from

285. *See supra* notes 206–207, 215–219 and accompanying text.

286. *See supra* notes 215–219 and accompanying text.

nondigital, direct evidence. The human eyewitness will be replaced by a digital e-witness with similar questions about reliability, accuracy, perception, and technical expertise—all within the parameters of traditional evidence rules.[287] Just as the eyewitness might erroneously judge the speed of the car before a crash, so might the computer err, but as a form of direct evidence the information is doing a similar thing in trial.

Smart devices, however, also provide *indirect evidence*—for example, data about how fast that car normally drives, especially on a particular road and around a particular time. The average speed of a car on the same part of a highway over the last thirty days offers a prediction of the speed on the day of the accident. This second type of indirect digital evidence is new.

Indirect digital evidence will almost always be available in a world of smart devices to bolster existing proof. Another way to think about the revolutionary potential of digital habit evidence is to recall all the sources of data in Part II. All of those patterns and revealing pieces of our lives are now available, collectable, and potentially helpful to litigants. Digital habit evidence turns the digital noise of daily life into a concrete, quantifiable thing to be weaponized in trial.

Indirect digital habit evidence will be used to fill in the gaps where there is no direct evidence. In these pure digital habit cases, the data and inferences therefrom will be the sole evidence presented. For example, in the oft-taught hypothetical of a deadly car accident on a deserted road with no survivors or witnesses (or any smart data from the car), the past acts of the drivers—reduced to digital habit evidence—might be dispositive evidence. Data as habit as fact will be used to prove competing claims.

Separately, even in cases with ample direct proof, digital habits will be used to corroborate or bolster that direct evidence.[288] While not

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287. Antigone Peyton noted in her article that:

> It will be interesting to see what happens when a witness's sensory experiences—his or her sight, sound, feeling, taste, etc.—clash with the data reported by their wearable device. For example, if a biker testifies that they were traveling down a hill towards an intersection at about 15 miles per hour, but their wearable device or Strava app reports the speed down the slope at 25, as determined by a complicated three-dimensional GPS reading and reporting algorithms—the debate becomes which "witness" will the jury give more credit.

Peyton, *supra* note 237, at 398.

288. In doing away with the common law "no eyewitnesses rule," the drafters adopted the idea that habit evidence could be admitted even when there were eyewitnesses and even when such evidence is cumulative.

as necessary or even as convincing as direct proof (for example, the actual speed of the car), litigants will seek to bolster their case with circumstantial habits that make their arguments more likely (for example, the pattern of past speeds of the car). This means in almost all cases, litigants may seek to introduce data as habit evidence.

To imagine the allure of digital habit bolstering, all one must do is think about whether a litigant would want background support for any critical fact at trial. Take a narrow issue about whether the car was speeding before an accident. One party has direct digital proof from the car's black box digital recording that the car was going eighty-eight miles per hour. The other party contests the accuracy of the digital fact with a series of experts and other impeaching sources of information. Although either party could win the case if the jury believes their evidence proving the car's speed, both parties would be quite tempted to provide evidence about the driver's habits. If the driver routinely drove over eighty-eight miles per hour, that fact would likely influence a jury that it was more plausible it happened in the instant case. If the driver never drove over eighty-eight miles per hour, that fact might provide support for the defense that something was erroneous about the speed estimate. The point is that even with direct digital proof, litigants will be tempted to bolster points with indirect digital habit evidence. And, if digital habit evidence is admissible under the rules as this Article argues, this type of bolstering evidence will become a common occurrence.

3. *Expanding Discovery*. Expanded definitions of relevance and proof also impact the scope of discovery.[289] With digital evidence, the scope of discovery will expand because the argument that some of this information could be used as habit is compelling. For litigants faced with the challenge of investigating a crash without eyewitnesses, this

289. For example, Magistrate Judge Matsumoto noted that,

> The scope of discovery is defined by Fed.R.Civ.P. 26(b)(1), which permits discovery "regarding any matter, not privileged, that is relevant to the claim or defense of any party . . . ." The information sought need not be admissible at trial to be discoverable—"all relevant materials which are reasonably calculated to lead to the discovery of admissible evidence should be discoverable."

Barrett v. City of New York, 237 F.R.D. 39, 40 (E.D.N.Y. 2006) (citations omitted); *see also* Dominguez v. Hartford Fin. Servs. Grp., Inc., 530 F. Supp. 2d 902, 907 (S.D. Tex. 2008) ("The scope of criminal discovery is significantly narrower than the scope of civil discovery. . . . For example, criminal defendants may not obtain discovery from third parties or depose a prospective Government witness unless the prospective witness is unable to attend trial." (citations omitted)).

type of digital discovery will be too tempting to resist. Whereas in a pre-digital age, the past records of driving would not have been considered discoverable (because they were neither relevant nor admissible), now with available data and a broader conception of habit, the argument might be quite different. Discovery battles will be fought around past acts, with arguments about relevant acts dominating the facts surrounding the incident.

The scale of this discovery change matches the scale of the digital records being created and mined about our lives.[290] The locational data in a smartphone dates back almost to the purchase of the device.[291] Patterns of movement, travel, speed, and regular travel habits will almost always exist as potential discovery.[292] This will be tempting for litigants with both legitimate claims for revealing habits and large-scale fishing expeditions that might border on harassment and will certainly lead to invasions of privacy.

4. *Defensive Habit.* If the thesis of this article is correct—that digital habit evidence will expand what is brought into trial—it is also necessary to recognize that this expansion will impact how litigants prepare for and defend lawsuits. Once aware that digital clues will be admissible, repeat players, who have ongoing litigation risk, can act defensively.[293]

Medical malpractice cases offer a good example. For example, imagine a medical malpractice claim is filed against a hospital. A patient fell in their room, and no one found them for hours, which caused additional physical injury. The hospital insists that nurses check on rooms every thirty minutes as a routine practice. Although there is

290. *See* George L. Paul & Jason R. Baron, *Information Inflation: Can the Legal System Adapt?*, 13 RICH. J.L. & TECH. 10, 21 (2007) (discussing the growth of electronic data impacting the legal profession).

291. *Privacy Breakdown of Mobile Phones*, SURVEILLANCE SELF-DEFENSE (May 6, 2021), https://ssd.eff.org/en/playlist/privacy-breakdown-mobile-phones#mobile-phones-location-tracking [https://perma.cc/P7BH-6RV6].

292. The amount and scale of the data is quite revealing. As these two *New York Times* stories demonstrate, the type of personally revealing information that can be inferred from smartphone data is disturbing: Stuart A. Thompson & Charlie Warzel, Opinion, *Two Million Phones, One Dataset, Zero Privacy*, N.Y. TIMES (Dec. 19, 2019), www.nytimes.com/interactive/2019/12/19/opinion/location-tracking-cell-phone.html [https://perma.cc/DQ76-E6H9]; Valentino-DeVries et al., *supra* note 231.

293. The types of entities at issue might be hospitals, warehouses, industrial worksites, universities, and other large organizations that are regularly sued for negligence but have regularized workplace practices and systems in place.

no evidence that anyone visited during the hours the patient lay on the floor, the hospital wants to introduce habit evidence that nurses routinely enter all occupied hospital rooms.

In a hypothetical case involving the alleged negligence of a hospital for failure to check on a patient, a hospital might introduce evidence of routine practices to counter the allegation that a nurse was negligent in failing to go to a room.[294] For example, the hospital expert might call a witness to explain the regular practice to check every hospital room every fifteen minutes or adduce testimony from a nurse that as a habit they always check on each room every fifteen minutes. Both examples would be permissible examples of habit evidence.

In a digital habit evidence situation, the hospital could use data to show that the hospital's routine practice of sending nurses into rooms at a set time undercuts the plaintiff's assertion that the nurse's failure to enter was negligent. Hospitals could track the RFID chips in nurses' badges to demonstrate the routine practices of the nursing staff. The pattern created by the hospital nurses' digital badge data might be quite helpful in defending against the negligence allegation.

Essentially, hospitals would be able to admit evidence on the routine practice of prior nonnegligent activity. Normally, such evidence is irrelevant because it does not relate to the act in question, but the theory of digital habit evidence changes the calculus. Hospitals will have every incentive to create this type of routine practice showing no fault in all aspects of their care. The same is true for other entities that find themselves in repeated litigation.

5. *Aggregation of Human Patterns*. Finally, at a more macro level, the aggregation of data collected from many different people and sources also impacts what might be used in court.[295] This Article has

294. *See, e.g.*, Rodney D. Wallace, *Electronic Surveillance of Nurses in the Workplace: Ethical Considerations*, 23 ONLINE J. ISSUES NURSING (2018), https://ojin.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Vol-23-2018/No2-May-2018/Electronic-Surveillance-of-Nurses.html [https://perma.cc/TV2E-7AZZ] (noting that nurses "are likely to encounter surveillance, just as do many employees in other industries"). Lawsuits against hospitals alleging a breach of a duty to care are quite common. Medical malpractice claims that arise from routine caregiving in hospitals, nursing homes, and other institutional settings generate regular litigation. *See Shocking Medical Malpractice Statistics for 2021*, RAYNES & LAWN (Jan. 31, 2022), https://rayneslaw.com/shocking-medical-malpractice-statistics-for-2021 [https://perma.cc/LKT3-CCU4] ("An average of 20,000 medical malpractice lawsuits are filed each year in the U.S.").

295. Thank you to Professor Maggie Wittlin for this insight.

tended to focus on individual habits to prove particular facts because the language of FRE 406 focuses on "a person's habit" "to prove that on a particular occasion the person" "acted in accordance with the habit,"[296] but the reality is that the data is being collected and aggregated at a much broader scale. That aggregation about patterns of behavior could also expand digital proof in ways that are not the norm today or available under a plain reading of FRE 406.[297] For example, in the automobile accident case, knowing the aggregate data of how fast everyone drives[298] on a particular street might impact a determination of reasonableness. Data showing that everyone speeds on that particular block or no one stops at a particular light might shape a jury's conception of reasonable actions. In a pre-digital era, jurors might be required to evaluate posted speed limits and commonsense driving inferences from observation. But with available digital technology, a fact-finder could find the speed of most cars on most roads and come to a determination of a reasonable, average speed. Or the discovery of a pattern of accidents at the same corner might undercut allegations of parties' personal negligence. Although in the ordinary course of trial, these types of habits built from other people's patterns would be irrelevant, someday they might be reimagined as relevant to reasonableness.

Without overstating the potential change digital habit evidence might portend, the simple fact is that all of the Internet of Things and smart device sensors discussed in Part II may generate relevant and admissible evidence under this theory. Creative litigants who comprehend the value of data trails—as direct, indirect, aggregated, or background evidence—now have a doctrinal tool to admit digital habit evidence. With such a malleable and broadly written rule, FRE 406 opens the door to a new world of relevant digital proof.

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296. FED. R. EVID. 406.

297. This is not to say that empirical data does not play a role in crafting background reasonableness arguments on occasion, but the form, type, and amount of data will change with the growth of the Internet of Things.

298. Jan Whittington, *Remembering the Public in the Race to Become Smart Cities*, 85 U.M.K.C. L. REV. 925, 928 (2017) ("Smart technologies offer the promise of real-time data with remarkably thick flows of information . . . traffic operations personnel can have the real-time traces of persons through the road networks of the city, sent in continuous signals from their automobiles, phones, and computers to networked Wi-Fi and Bluetooth sensors.").

C. Complications of Digital Habit Evidence

The expansion of digital habit evidence is not without complications. Habit evidence has always uncomfortably coexisted with other doctrines around inadmissible character evidence and prior bad acts.[299] This Section briefly explores how expanding digital habit evidence creates tension with those existing limitations.

1. *Confusing Character Evidence*. One complication might be how digital habit impacts character evidence prohibited under FRE 404(a) and 404(b)(1).[300] The line separating permissible habit evidence and impermissible character evidence has long been unsatisfying.[301] Many identifiable habits reveal a certain character, and the inferences are hard to ignore.[302] A habit of driving the speed limit suggests a character for carefulness, just as a habit of speeding suggests a character for recklessness. The theory has always been that courts allow habit evidence because of its specificity and lack of moral overtones of a particular act, whereas courts disallow character evidence because it reveals too much about the person independent of the act at issue.[303]

For example, imagine a young man routinely goes to a bar, drinks alcohol to excess, and gets in a bar fight around closing time. His smartwatch routinely captures the elevated heartbeat, the exertion, the impacts of alcohol, and the time and location of his visits to the same bar. After one particular Friday night fight, he is sued for assault and battery and the resulting injuries. At trial, there is an open question of

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299. *See supra* Part I.A.3.

300. FED. R. EVID. 404(a), (b)(1). Steven Goode also stated that,

> Rule 404(b)(1) prohibits the introduction of evidence of a person's other crimes, wrongs, or acts if offered to prove the person's character so that the factfinder might infer that the person acted in accordance with that character on the occasion in question. Put another way, Rule 404(b)(1) excludes other-acts evidence if its probative value requires a character-propensity inference.

Steven Goode, *It's Time To Put Character Back into the Character-Evidence Rule*, 104 MARQ. L. REV. 709, 712 (2021) (citations omitted).

301. United States v. Yazzie, 188 F.3d 1178, 1190 (10th Cir. 1999) ("Habit evidence may offer a backdoor to proving character . . . .").

302. Sandifer v. Hoyt Archery, Inc., 907 F.3d 802, 806 n.4 (5th Cir. 2018) (noting that "the line between inadmissible character evidence and admissible habit evidence" quite often "may become blurred" (quoting Reyes v. Mo. Pac. R.R. Co., 589 F.2d 791, 794–95 (5th Cir. 1979))); *see also* Taslitz, *supra* note 99, at 109 ("[C]haracter differs from habit in that character concerns general dispositions to behave in a certain way, a quality thought to have less predictive power in a given situation than the automatic reaction that is habit.").

303. *See supra* notes 52–55.

who started the fight. The plaintiff wishes to bring the digital information about past acts of intoxication and violence as evidence to show it is more likely that the young man started the fight. Under traditional rules, evidence of past fights would likely be barred by the prohibition on propensity evidence, unless the defendant opens the door to the testimony.[304] But as habit evidence, the same information of location, time, heart rate, intoxication, and exertion could come in under FRE 406. If the question is framed as, "Is this person regularly drunk at a bar at closing time with an elevated heartbeat?," then the answer is "yes." The problem, of course, is that all of the same negative character inferences that might be excluded from evidence in the ordinary character evidence analysis would find another way into evidence as habit. The already blurred line between habit and character would become even harder to see. A judge should, of course, keep out this "propensity recharacterized as habit" evidence, but it does fit within the expansive habit rule.

At a deeper level, how the data is collected might have its own character-like problem. For example, the fact that a driver owns a real-time insurance app, which calculates premiums based on safe driving, says something revealing about the character of the individual who owns the "smart" insurance policy. By voluntarily opting to install an app that measures safe driving, you are making a statement, independent of the actual driving, about your overall care in driving.

In fact, the whole idea of "the quantified life"—of wanting to measure fitness, health, and "smart" living—is a statement about character.[305] Individuals who sign up to be monitored for self-awareness and personal enlightenment are making a quasi-moral statement about their lives and measuring their lifestyle outputs. The open question is whether a litigant can introduce data from a smart device for habit reasons that does not also speak volumes about the character of a person owning the smart device. Simply using certain Internet of Things devices such as smart water glasses, smart toothbrushes, and smart toilets reveals something about the character, wealth, and privilege of the owner, such that the underlying habit data is overshadowed by the moral overtones of owning the device itself. Thus, as one might imagine, litigants can create some mischief in

304. FED. R. EVID. 404(a)(2).

305. Or, at a minimum, it is an aspirational statement about a hoped-for character for fitness, health, and self-awareness. In reality, the quantified truth might be as revealing as a New Year's resolution to go to the gym more often.

introducing backdoor character evidence by referencing the types of devices that collect digital habits. In other words, the traditional theory, which tried to draw a line between specific acts and general disposition, falls apart when the collecting mechanism for the acts involves a statement about character. Litigants hoping to sneak character in through habit and those wishing to keep habit out by invoking the character rule will find arguments for their position.

Character has always been a contested and confusing rule,[306] so perhaps the addition of digital habit evidence merely confirms the difficulty in line drawing. The best that can be said is that the blurring of habit and character with smart data reveals how unhelpful the line has been. Habits have always inferentially revealed character, and smart data just makes that reality more visible. Like with many things, data quantification merely offers new ways to visualize what we know to be true.

2. *Predicting from Prior Bad Acts*. Similar to the tension in admitting character evidence using habit, prosecutors seeking to admit prior bad acts under FRE 404(b)(2) might be able to use habit evidence as a backdoor way to get in prior criminal patterns.[307] Again, the argument here is that the broadly written rule around habit evidence, combined with new forms of digital patterns, allows prior bad acts to come in under FRE 406 and avoids the limits of traditional FRE 404(b)(2) analysis.

For example, assume a known drug dealer was killed in the home where he allegedly sold drugs. The defendant is suspected of being a supplier who delivered drugs every Friday at approximately the same time. The defendant's car and phone were tracked to the location at the same time every Friday for months leading up to the killing. No direct evidence was found on the Friday of the murder; the killer was wise enough to leave his devices at home. But the pattern of trips at the same time leads police to suspect the defendant is the killer.

As described, the homicide case is largely circumstantial. No direct evidence connects the suspect with the murder, but a pattern of activity at earlier times and the same place predicts his involvement in matters

306. Paul S. Milich, *The Degrading Character Rule in American Criminal Trials*, 47 GA. L. REV. 775, 779 (2013) ("[T]he character rule has become porous with exceptions and unpredictable in application.").

307. FED. R. EVID. 404(b)(2) (allowing past acts to prove "motive, opportunity, intent, preparation, plan, knowledge, identity, absence of mistake, or lack of accident").

on the date in question. This circumstantial case has many challenges, but one such challenge is how the prosecution can prove the defendant was present using inferences from past acts.

In a traditional case, prosecutors have several evidentiary arguments to admit the trips to the decedent's home at prior times. Prior bad acts under FRE 404(b) might allow evidence of prior trips to supply drugs as either part of a common scheme or plan[308] or as motive evidence,[309] if the theory of the case suggests a connection between the drug dealing and the killing. Without more evidence, the defense will have a compelling response that such evidence is more prejudicial than probative (introducing additional criminality into the case)[310] and largely speculative that this connection was the reason for the murder (many others may have motive for the murder).

Habit evidence, however, offers a new avenue for admission of the same pattern of behavior. For months, a defendant has visited the same place at the same time, which corresponds to the time of the murder. This digital pattern of behavior—implicating time, duration, and location—predicts a similar act on the day in question. Even without direct proof of what happened on that day, the past repeated acts offer habit evidence from which to infer guilt. Unlike the objection to the FRE 404(b) evidence that such prior bad acts are inadmissible, habits are admissible, only with the restraint of Rule 403. Although a judge

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308. Professor Charles Alan Wright and Professor M. Miller stated that:

> Another definitional issue involves "modus operandi." Evidence of a distinctive "modus operandi" can be useful in identifying the perpetrator of a particular crime, but it is doubtful that this sort of criminal "habit" falls within the meaning of Rule 406. Since "modus operandi" can be proved by specific instances under Federal Rule of Evidence 404(b) in order to identify the criminal, the only reason for attempting to bring it within Rule 406 would be to permit proof by opinion. While there may be cases in which the commission of crime in a particular way can properly be considered to be a habit, in most cases it would seem better to admit the evidence under Rule 404(b) rather than stretch Rule 406 to cover it.

WRIGHT & MILLER, *supra* note 37, § 5273 (citations omitted).

309. Professor Milich stated that:

> [T]he distinction between legitimate "propensity free" inferences from character evidence and disfavored propensity uses is far from clear and is difficult to apply. Many of Rule 404(b)'s admissible uses of character evidence are more or less dependent on propensity inferences. The state of mind exceptions (motive, intent, plan), for example, often involve propensity inferences to one degree or another and sometimes these inferences are necessarily based on the defendant's character.

Milich, *supra* note 306, at 786.

310. There is always a Rule 403 prejudice argument still available. *See, e.g.*, United States v. Edouard, 485 F.3d 1324, 1344 (11th Cir. 2007) ("[T]he probative value of the evidence cannot be substantially outweighed by undue prejudice . . . .").

can still preclude the pattern of behavior as prejudicial, the arguments against habit evidence are harder.

Of course, not all prior bad acts will be habitual. But opening the door to additional past acts to prove the likelihood of a present action will be quite tempting. In fact, with available data, jurors might come to expect this kind of proof in a criminal case. Scholars and judges have debated the "CSI Effect" in forensic investigations.[311] The general idea is that steeped in television shows such as CSI, jurors have been primed to expect high-tech forensic scientific evidence, even in the most mundane of cases.[312] Similar to the CSI Effect, we might see an "Internet of Things Effect" where the prevalence of smart devices will nudge jurors into assuming there must be digital evidence or predictions therefrom, punishing prosecutors for not collecting it.[313]

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311. *See* Kimberlianne Podlas, *"The* CSI *Effect": Exposing the Media Myth*, 16 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 429, 461 (2006) ("[F]requent viewers of *CSI* are no more influenced by *CSI* factors than are non-frequent viewers."); Kimberlianne Podlas, *The* "CSI *Effect" and Other Forensic Fictions*, 27 LOY. L.A. ENT. L. REV. 87, 88 (2006) ("Contrary to the hype, the empirical data does not support the existence of a *CSI* Effect . . . ."); *see also* Taylor v. State, 249 A.3d 810, 813 (Md. 2021) (discussing how courts in Maryland have addressed the CSI effect, including by using jury instructions).

312. Professor Tom Tyler explained the CSI effect:

> The "CSI effect" is a term that legal authorities and the mass media have coined to describe a supposed influence that watching the television show CSI: Crime Scene Investigation has on juror behavior. Some have claimed that jurors who see the high-quality forensic evidence presented on CSI raise their standards in real trials, in which actual evidence is typically more flawed and uncertain. As a result, these CSI-affected jurors are alleged to acquit defendants more frequently.

Tom R. Tyler, *Viewing* CSI *and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction*, 115 YALE L.J. 1050, 1050 (2006).

313. One court has called this the "tech effect" as a parallel to the CSI effect. People v. Pike, 53 N.E.3d 147, 173 (Ill. App. Ct. 2016) ("Instead, what may be afoot is a broader 'tech effect.' . . . The backgrounds and experiences of jurors today are different than they were in previous generations."). Professor Riana Pfefferkorn has suggested we might see a similar effect with digital video and the concern with deepfake videos:

> Indeed, there is a chance that litigators will start seeing a sort of "reverse *CSI* effect." The "*CSI* effect" refers to the phenomenon of jurors demanding high-tech evidence even in run-of-the-mill cases, thanks to the popular TV police procedural. Similarly, the availability of software for authenticating real video, and of sophisticated AI tools for detecting deepfakes, may have an unintended consequence. If jurors know such tools exist, they may accord little weight to a video unless the proponent either proves the positive—by showing the video was captured via a video-authentication tool and thus should be considered authentic—or proves the negative, by using the latest detection technology (possibly at great expense) to satisfy the jury that the video is *not* a deepfake. Traditional means of persuading juries, such as the introduction of witness testimony to vouch for a video, may no longer work as well as they do now.

Riana Pfefferkorn, *"Deepfakes" in the Courtroom*, 29 B.U. PUB. INT. L.J. 245, 270–71 (2020) (citations omitted).

Although the CSI Effect may have been overstated in practice,[314] there is a natural inclination to want more evidence for a criminal conviction. So when potential digital clues exist, there will be another point of pressure to introduce this evidence. When prosecutors do not have direct digital evidence of a crime, they may look to satisfy the Internet of Things Effect with digital habit evidence of prior bad acts. The background data might provide corroboration or a pattern to support the criminal accusation.

CONCLUSION

The rules of trial evidence were designed for a pre-digital world, where the facts outside the courtroom needed to be proved by rough and imperfect proxies. Doctrines around "habit," "character," and "reliability," among others, were all designed to fill in the gaps of documented fact. With the advent of digital technologies tracking where we go, what we do, and even our heartbeats when we do those activities, the world of proxies is being replaced by digital proof. This insight offers the opportunity to reimagine new rules of evidence for a digital world.

Digital habit evidence is one such rule that offers a path—consistent with existing Federal Rules of Evidence and common law traditions—to expand the use of data trails to trial. The combination of a broad rule, limitless data, and the growing ways we have quantified our lives will make the doctrine attractive to litigants seeking to bolster their arguments.

At the same time, like much of our digital experimentation, the risks from this disruptive innovation have not been fully calculated. The insights of this Article demonstrate an available path forward consistent with existing rules, but it does not conclude that this path is necessarily a positive development. A greater use of digital habit evidence assumes the continued existence of digital surveillance technologies. After all, a world where everything is evidence creates risks about who holds power in society. Companies that create, mine, and sell data gain power.[315] Governments that use data to surveille

314. *Pike*, 53 N.E.3d at 171–72 ("[T]he popular notion that there is a 'CSI Effect' as something that motivates jurors cannot be demonstrated by any current reliable empirical study. All we have are anecdotal stories and media hype.").

315. *See generally* Andrew Guthrie Ferguson, *Surveillance and the Tyrant Test*, 110 GEO. L.J. 205 (2021) (addressing technology companies providing data to law enforcement).

citizens gain power.[316] Whether seen in terms of surveillance capitalism,[317] big data surveillance,[318] or just creepy consumerism,[319] the growth of the Internet of Things in our homes, bodies, and lives means less power and autonomy for individuals. A rise in digital habit evidence will accelerate these trends and entrench power in those who control the data.

At the same time, the data currently exists in the world and reveals our personal and professional habits. Smart data is, after all, just us represented in binary code. Under existing evidence law, this habit information is fair game for litigants to use. And, as the idea of digital habit evidence becomes more accepted, it will become more commonplace in trial. In fact, because of its perceived quantifiable nature, digital habit evidence might become a preferred form of proof.

316. *Id.* at 205.

317. SHOSHANA ZUBOFF, THE AGE OF SURVEILLANCE CAPITALISM: THE FIGHT FOR A HUMAN FUTURE AT THE NEW FRONTIER OF POWER 8 (2019).

318. *See generally* Sarah Brayne, *Big Data Surveillance: The Case of Policing*, 82 AM. SOCIO. REV. 977 (2017) (examining the adoption of big data analytics in surveillance practices).

319. *See* Joshua McNichols, *A Smart Home Neighborhood: Residents Find It Enjoyably Convenient or a Bit Creepy*, NPR (Nov. 9, 2019, 3:04 PM), www.npr.org/2019/11/09/777747209/a-smart-home-neighborhood-residents-find-it-enjoyably-convenient-or-a-bit-creepy [https://perma.cc/J5KF-MERD].