Trial by Google Maps? The Dangers of Admitting Privatized GIS Technology by Judicial Notice

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TRIAL BY GOOGLE MAPS? THE DANGERS OF ADMITTING PRIVATIZED GIS TECHNOLOGY BY JUDICIAL NOTICE

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INTRODUCTION

What side of the border was he on when he was arrested? How far is the factory from the school? How long does it take to drive from San Diego to San Francisco? Was there a hospital within reasonable driving distance? These are some of the questions that may arise in a trial. More importantly, the answers to these questions are generally found on a map. Geographic information is, and has long been, an invaluable tool in the resolution of legal issues. However, the evolution of maps has created unique legal issues. Specifically, the traditional paper map, singular and inflexible, has been subsumed by dynamic, multifaceted, digital mapping systems. As maps have undergone significant structural changes, the evidentiary frameworks governing their admissibility must also change.

In the early 2000s, new technologies associated with geography and mapping began to emerge. Immediately, legal scholars and courts began grappling with the applicability and admissibility of these technologies in the courtroom. In particular, the emerging availability of Geographic Information Systems (“GIS”) to laypersons has shaped the dialogue around admissibility. Most people are likely familiar with the following GIS: MapQuest, Google Maps, and Apple Maps. These GIS allow everyday users to navigate the world around them, to search for businesses, to predict the length of their morning commute, and more. This technology has become a staple in the home and on the phone; now, courts are making a place for this technology in the courtroom.

1. See, e.g., cases cited infra notes 58, 60, 61, 128; Jeffrey Bellin & Andrew Guthrie Ferguson, Trial By Google: Judicial Notice in the Information Age, 108 NW. UNIV. L. REV. 1137, 1161–63 (2014) (explaining that traditionally, judges could take judicial notice of geographic information—ultimately contributing to the resolution of legal issues); see also Gregory W. Segal, Clashing Standards in the Courtroom: Judicial Notice Of Scientific Facts, 51 COLUM. J.L. & SOC. PROBS. 523, 524 (2018) (noting that the applicability of judicial notice to “basic geography” is rooted in the idea that such geographic features possess an inherent indisputability).


Google released its GIS on February 8, 2005, and while it was not the first of its kind, Google Maps is now “the ubiquitous cartographic platform . . . .” In particular, the system’s perceived authority is attributed to its user-friendly interface and inherent applicability to everyday life. Beyond everyday users, Google Maps is commonly used within other websites and applications by way of its application programming interface (“API”). This ubiquity is also likely the reason why some legal scholars chose to study the specific admissibility of Google Maps and the evidentiary frameworks to which it is best suited. Likewise, courts across the country are now addressing the admissibility of Google Maps, as well as its sister system, Google Earth, in both civil and criminal trials.

Courts and scholars alike have shown an acceptance of, and, in some instances, a preference for, judicial notice as the appropriate framework for admitting evidence sourced from Google Maps.

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7. See id. at 121.


10. See generally United States v. Lizarraga-Tirado, 789 F.3d 1107 (9th Cir. 2015) (evaluating the applicability of hearsay, authentication, and judicial notice as admissibility frameworks for Google Earth); see also cases cited infra notes 58, 60, 61, 128.
Proponents of utilizing judicial notice to admit GIS information cite various factors, such as Google’s financial incentives to produce an accurate product, as indicia of reliability.\(^{11}\) This is not an entirely radical concept because historically, geographic information fell within the scope of judicial notice.\(^{12}\) As a result of this preference; however, evidence sourced from Google Maps is allowed to circumvent the authentication requirements that a computational system would normally be required to meet, and instead is presumed to be reliable by courts.\(^{13}\) By engaging in this practice, courts run the risk of placing unreliable evidence before the jury, which is especially problematic in civil trials, given the binding nature of judicial notice on the jury.\(^{14}\)

Even in criminal trials,\(^{15}\) absent the information obtained through the authentication process, juries are unlikely to actively consider the reliability of a GIS source, making judicial notice implicitly binding here as well. The harm created by this approach is not only case-specific; it also poses a greater threat to the American adversarial legal system and the legitimacy that system fosters.

This Comment will explore the misguided preference for computer-generated evidence, using Google Maps and Google Earth as case studies. Part I will provide a background on GIS—specifically how Google Maps goes from a series of data points to the map most people see on their phone. Part II will explore how courts currently engage with Google Maps, along with potential problems regarding data errors, objectivity, and transparency. Part III will consider how concerns about objectivity and human error in the jury motivate courts’ use of judicial notice. Part IV will address how taking judicial notice of the inherent reliability of privatized GIS technology threatens the rights of adverse

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11. See Bellin & Ferguson, supra note 1, at 1177 (arguing that Google presents no risk of bias and is financially incentivized to produce a reliable product); Godwin, supra note 9, at 219 (suggesting that Google Maps and similar GIS present courts with an opportunity to expand the scope of judicial notice). But see Katz, supra note 6, at 85–86 (raising bias and transparency concerns about the use of Google Maps in resolving international border disputes).

12. See Bellin & Ferguson, supra note 1, at 1163; Segal, supra note 1, at 524.


14. FED. R. EVID. 201(f).

15. In criminal trials, the impact of judicial notice is tempered by the requirement that the jury must explicitly be given a choice as to whether they accept the judicially noticed fact as conclusive. Id.
parties and the legitimacy of the courts. Finally, Part V will suggest alternative frameworks, which address the issues raised herein. Specifically, Part V will (1) argue for requiring privatized GIS to satisfy authentication requirements; (2) suggest mutual stipulation by adverse parties as a safeguard for judicial economy; and (3) propose revisions to the statutory language of federal judicial notice to account for the dangers presented by privatized technology and to correct harmful precedent.

I. GIS AND THE INTEGRATION OF DATA TO CREATE USABLE MAPS

At the most basic level, GIS are computer systems that are “capable of assembling, storing, manipulating, and displaying geographically referenced information” about the physical world as “a collection of thematic layers” connected by geography.” These systems are valuable because they can “overlay multiple sets of databases into a map format that graphically explains the relationships between the data,” and the dynamic nature of these maps ensures they can be quickly updated when new information is input. These features allow the user to interact with spatial data in a useful and flexible way, something simply not possible when using a static map.

A. Understanding the Data Sources Used by Google Maps

Like other GIS, Google Maps amasses large amounts of data and uses that data to populate its map. Google collects its data from the following combination of sources: Map Content Partners, satellite imagery, Google Street View vehicles, location data from everyday users of Google Maps, and contributions from Local Guides. Some might argue that this wide variety of sources will ultimately reduce the likelihood of error because sources can be used to cross-check one another and resolve discrepancies. The use of external sources,

17. Id. at 224.
19. Id. See infra Section I.A. “Local Guides” for a discussion of Local Guides and how their data contributions fit into Google’s map-making process.
however, and the variation therein, may actually heighten the risk of introducing errors. Because some of the data is gathered for purposes other than populating Google’s maps, Google likely has no control (and potentially no oversight) over that portion of the data at the time it is collected and processed by those sources.

1. Map Content Partners

Using its Base Map Partner Program, Google accumulates “detailed vector data” from an extensive list of organizations, including various government agencies and an assortment of “trusted public, private or non-profit organizations.” The way in which these datasets are collected and organized by these various sources can impact their tendency to include errors, contributing to the reliability of the map in which they are used.

2. Satellite Images

According to Google Maps director of product Ethan Russell, the company currently obtains all of its satellite imagery from third parties. Through the process of photogrammetry, the mass of

20. It is unlikely that external organizations actively consider the impact of their data collection and organization methods on secondary uses of that data while those processes are underway. See discussion infra Section II.D for an elaboration of how different sources’ biases can shape how they organize data.


22. Nightingale, supra note 18 (listing contributors of data to Google, including the U.S. Department of Agriculture Forest Service, the U.S. National Park Service, the U.S. Geological Survey, and various city and county councils).

23. Map Partners, supra note 21 (the list of Map Partners also includes, but is not limited to, healthcare providers, agencies, non-governmental organizations, and universities, as well as “organizations using Google’s maps and APIs”).

24. Richard Nieva, Google Maps Has Now Photographed 10 Million Miles In Street View, CNET (Dec. 13, 2019, 9:01 AM), https://www.cnet.com/tech/tech-industry/google-maps-has-now-photographed-10-million-miles-in-street-view/. Google initially planned to produce its satellite data internally. Id. In 2014, Google bought Sky Box, a high-resolution satellite imaging company that Google said would help “keep [Google’s] Maps app up to date,” only to sell the company a mere three years later. Id.

25. “Photogrammetry is not new. While it originated in the early 1900s, Google’s approach is unique in that it utilizes billions of images, similar to putting a
“commercially-available satellite imagery” is overlayed and combined to “create a seamless map.”26 The satellite images are constantly updated, but not everywhere at the same rate.27 The temporal inconsistency of updates means that at any given time, satellite imagery on some portion of the map is likely outdated.

3. Google Street View

In 2007, Google Maps added Street View to its data collection arsenal as part of a new effort it called “Ground Truth.”28 Specialized vehicles “fitted with nine-lens cameras” travel around capturing panoramic photos which are then analyzed by Google’s computers and reviewed by human operators.29 Street View was introduced as a means of quickly correcting errors in data, a vital tool when considering that most of Google’s map-building data is external.30 Yet, because the driver’s route shapes the data collection process, it is possible that critical information could be missed or, as is the case with satellite imagery, portions of the map may become outdated and inaccurate.

4. Location Data


27. Id. (explaining that satellite data for large cities, which experience more frequent change, is updated annually, whereas for medium to smaller cities, Google updates the data every two or three years).


30. Id.
and pinpointing road diversions.”31 This user-specific data can be gathered both from these devices themselves32 and from within Google’s applications, including Google Maps.33 As the legal landscape around data privacy continues to evolve, it is unclear how Google’s use of location data to develop its GIS will fare.

5. Local Guides

Local guides are accredited members of a subset community within the greater scope of Google Maps users.34 Google uses online badges to incentivize members to contribute to its maps.35 Like the other data that Google obtains from external sources, these contributions are processed by “a combination of machine learning algorithms” and Google Maps team employees.36 Data produced by local guides presents risks to reliability, similar to those presented by Google’s Map Partners. Biases may impact contributions, leading to the production of unreliable data.

B. How Google Maps Processes Data

After the data has been accumulated—a constant and ongoing process—Google’s algorithms process the information.37 These algorithms use machine learning to compare existing data with new data

33. Id. Within Google’s applications, the company can also obtain location data from past activity, such as saved or labeled places. Id.
34. Katz, supra note 6, at 85–86.
35. Guides can make these contributions “by suggesting an edit, sending feedback, leaving reviews or ratings of local businesses, reporting issues, or using the ‘add a missing place’ function.” Id.
36. Id. at 86.
37. Nightingale, supra note 18.
and identify discrepancies. These discrepancies are then used to update the current map. Finally, a team of human editors attempts to correct any potential errors missed or created by the machine, using an in-house map editing program called Atlas. Atlas shows a “hybrid satellite-map view” with various “colored lines and symbols” marking features such as roads. The editors cross-check information and make corrections manually. The program lets them “draw” to make changes, such as adding road connections or mapping out new buildings. The team also reviews complaints submitted by users and, accordingly, makes necessary updates. Because the Google Maps team conducts an intensive review before making information available to users, it may appear that errors resulting from the incorporated datasets are of minimal concern. The computational and human processes involved in producing the map raise separate, serious concerns about bias and the lack of transparency by Google, suggesting that users ought to view Google Maps-sourced evidence with a critical eye. Yet, courts have failed to consider these risks. In particular, the massive human effort behind creating the map is rarely acknowledged or discussed by courts. In fact, scrutiny and discussion regarding the human effort behind the GIS is entirely absent in cases where the court takes judicial notice of the accuracy of Google Maps or Google Earth.

39. Id.
40. Nightingale, supra note 18; Miller, supra note 28.
41. Miller, supra note 28.
42. Id.
43. Nightingale, supra note 18.
45. See discussion infra Section II.E (describing the tendency of courts to limit analysis of evidence sourced from Google Maps and Google Earth to a footnote in the opinion); see also infra note 128.
II. JUDICIAL NOTICE OF GOOGLE MAPS: PROBLEMS WITH DATA ERRORS, OBJECTIVITY, AND TRANSPARENCY

A. Judicial Notice

Judicial notice is a process by which a court declares, on the record, that a given fact is true for purposes of the trial—a determination ordinarily made by the jury—without requiring parties to produce evidence of that fact. In civil trials, judicial notice binds the fact in question upon the jury. In criminal trials, judicial notice is non-binding and requires the judge to “instruct the jury that it may or may not accept the noticed fact as conclusive.” Even in criminal trials, the use of judicial notice deprives the jury of alternate information, which can have an implicitly binding effect.

Judicial notice originated as a doctrine of common law. The modern iteration of judicial notice was codified as part of the Federal Rules of Evidence and adopted by Congress in 1975. Under Rule 201, a court may take judicial notice of facts that are not “subject to reasonable dispute” because they: (1) are generally known within a trial court’s territorial jurisdiction; or (2) are accurately and readily determinable from sources whose accuracy “cannot reasonably be questioned.” This procedural tool is commonly used to promote judicial efficiency and serves as a form of jury control, ensuring that juries’ findings are grounded in reality.

47. FED. R. EVID. 201(f).
48. Id.
49. For example, if a trial court takes judicial notice of the distance between a school and the site of an illicit drug transaction as calculated by Google Maps, the defense would have no opportunity to present evidence contradicting the calculation of that distance or to otherwise challenge the reliability of Google Maps by cross-examining a custodian. See FED. R. EVID. 901(b)(1). Thus, the jury would have no reason not to accept Google Maps’ calculated distance as conclusive. See generally id.
50. Godwin, supra note 9, at 227.
51. Id.
52. FED. R. EVID. 201(b).
53. Dansky, supra note 46, at 20.
As a result, judicial notice has become something of an evidentiary shortcut, giving litigants a means to “circumvent authenticity and hearsay hurdles” typically raised by internet sources. Nevertheless, the benefits of judicial efficiency do not eliminate the risk of admitting unreliable evidence, especially given the unique authentication challenges presented by internet or other computational sources.

B. Judges and Google Maps

Currently, courts have established two distinct ways to admit evidence sourced from GIS by way of judicial notice. The primary method involves taking judicial notice of facts displayed by GIS, such as the distance between two points or the general location of a building in a given area. The Ninth Circuit case, United States v. Perea-Rey, created harmful precedent by treating a Google map and a satellite image—at least for the purposes of determining the location of a home—as “sources whose accuracy cannot reasonably be questioned. In the following decade, numerous courts have relied on Perea-Rey, and have deemed information from Google Maps suitable for judicial notice.

54. Under Federal Rule of Evidence 901(b)(9), a proponent of evidence produced by a system must authenticate that evidence by providing additional evidence demonstrating the system’s tendency to produce accurate results. FED. R. EVID. 901(b)(1). Because this often necessitates the testimony of a custodian, the process generally takes longer than the application of judicial notice. Id.

55. Godwin, supra note 9, at 230.

56. Segal, supra note 1, at 547; see also discussion supra note 54 (demonstrating how judicial notice can minimize trial costs, by eliminating the need for custodial witnesses, as well as duration, by circumventing the need to direct and cross-examine said custodial witnesses, or otherwise present evidence for authentication purposes).

57. Godwin, supra note 9, at 231.


59. Perea-Rey, 680 F.3d at 1182 n.1.

60. See, e.g., Johnson v. DTBA, LLC, 424 F. Supp. 3d 657, 662 (N.D. Cal. 2019) (relying on Perea-Rey and finding that “[g]eographical information from
Alternatively, at least one court has considered taking judicial notice of GIS’s inherent reliability under Rule 901(b)(9). This approach, as exemplified by Ninth Circuit case, United States v. Lizarraga-Tirado, will be the primary focus of this analysis. In Lizarraga-Tirado, the defendant was charged with illegal re-entry into the United States. He argued that he was arrested south of the United States-Mexico border and challenged the government’s use of GIS data, a tack placed on a Google Earth image, as inadmissible hearsay. In its ruling, the Ninth Circuit made a distinction between maps featuring markers generated by humans and those generated by machines. The Court held that a map containing a mark placed by a human was hearsay, while a marker generated by a machine (Google Earth), was not. The Ninth Circuit did find, however, that such machine generated evidence was still subject to authentication requirements. Moreover, the Ninth Circuit noted that such requirements could be satisfied without a witness or custodian attesting to the reliability of Google Earth; instead, it held that it could take “judicial notice of the program’s reliability.”

Google Maps is also proper for judicial notice); see also, e.g., Tesoro Refin. & Mktg. Co. v. City of Long Beach, 334 F. Supp. 3d 1031, 1041–42 (C.D. Cal. 2017) (relying on Perea-Rey and taking judicial notice of location information gathered from Google Maps).

61. United States v. Lizarraga-Tirado, 789 F.3d 1107, 1110 (9th Cir. 2015) (musing that the burden of authentication might be satisfied “through judicial notice of the program’s reliability”); see also United States v. Brooks, 715 F.3d 1069, 1077–78 (8th Cir. 2013) (finding that the district court acted appropriately when it took “judicial notice of the accuracy and reliability of GPS technology.”). Readers should note that GPS and GIS are distinct systems performing separate functions. Dischinger & Wallace, supra note 3, at 21. GIS “collect, store, analyze, and visualize complex geospatial data,” while GPS use satellites to “calculate specific locations.” Id. Nonetheless, both types of systems implicate geographic information, and courts’ assumptions about their accuracy are similarly troubling.

62. See generally Lizarraga-Tirado, 789 F.3d 1107.

63. Id. at 1109.

64. Id. at 1108–09.

65. Id. at 1109.

66. Id. at 1109–10.

67. United States v. Lizarraga-Tirado, 789 F.3d 1107, 1110 (9th Cir. 2015).

68. Id.; see also FED R. EVID. 901(b)(9) n.9 (the advisory committee “does not . . . foreclose taking judicial notice” of a system’s accuracy). But see Taylor v. State, 353 So. 3d 1114, 1125 (Miss. Ct. App. 2023) (reversing a conviction on the basis that evidence gathered from Google Earth was not properly authenticated).
The Ninth Circuit’s acceptance of Google’s GIS as an unquestionably accurate source of evidentiary information raises a myriad of concerns. By encouraging courts to circumvent proper admissibility frameworks, such precedent not only threatens the legitimacy of individual trials, but also that of the American adversarial system as a whole.

Because judicial notice of complex, data-driven sources requires a discussion of the reliability of the sources in question, this analysis would be incomplete without an examination of whether Google Maps is a source “whose accuracy cannot reasonably be questioned.” Studies conducted to determine the relative accuracy of the system have documented some degree of inaccuracy. Furthermore, some criticism has been leveled at this admissibility approach on the basis that (1) as a private company, Google is not an objective source of information, and (2) its lack of transparency creates an added risk of inaccurate information. Each of these concerns are addressed in turn.

69. See discussion infra Sections II.C–E, III, IV.

70. FED. R. EVID. 201. This Comment posits that a court’s inquiry into the applicability of judicial notice of GIS is incomplete if the court lacks an understanding of how a system generates its map. Accordingly, this Author will delve first into an explanation of Google Maps’ process and then analyze the extent to which its accuracy can be reasonably disputed.

71. SHANKER LAL MEGHWAR ET AL., ACCURACY MEASUREMENT OF GOOGLE EARTH USING GPS AND MANUAL CALCULATIONS (Int’l Conf. on Sustainable Dev. Civ. Eng’g 2018) (“observ[ing] that manual calculation of distance and area is more accurate than that of Google Earth Pro measurements”); Andrea Macarulla Rodriguez et al., Google Timeline Accuracy Assessment and Error Prediction, 3 FORENSIC SCI. RSCH. 240, 253–54 (2018) (concluding that, although the errors recorded were not of a large magnitude, “Google locations and their accuracies should not be used in a definite way to determine the location of a mobile device”); Paredes-Hernández et al., Horizontal Positional Accuracy Of Google Earth’s Imagery Over Rural Areas: A Study Case In Tamaulipas, Mexico, 19 BOLETIM DE CIÊNCIAS GEODÉSICAS 588, 598 (2013) (providing a comparison of error vector magnitude data for developed and developing countries); David Potere, Horizontal Positional Accuracy Of Google Earth’s High-Resolution Imagery Archive, 8 SENSORS 7973, 7977–78 (2008), https://doi.org/10.3390/s8127973 (suggesting that Google Earth users should proceed with “caution due to the presence of large georegistration errors in both [Google Earth’s] medium and high resolution imagery.”).

72. Katz, supra note 6, at 73, 85–89.
C. The Accuracy and Precision of Google Maps Data

The beauty of a GIS like Google Maps lies in its ability to utilize data from several sources and create maps that are useful.73 Nonetheless, each dataset that Google incorporates has the potential to include errors which can, and do, make their way into the final product.74 These errors can lead to discrepancies between the map and the real world, by way of either inaccuracy or imprecision, and these discrepancies diminish the usefulness of the map.75 In order to understand the potential for error in GIS data, one must understand the distinction between accuracy and precision.76 Accuracy measures how closely the information on a map reflects its real-world counterpart,77 while precision measures the exactness of the data’s description when it is recorded.78 For example, accuracy means that a police station shown on a map matches its location in the real world, and precision means that it is correctly identified as a police station, not a private security firm.

It is particularly notable that Rule 201 addresses the accuracy of sources and not the precision of the information included.79 The current discussion between courts and scholars regarding Google Maps reflects such an absence; it focuses on the visual accuracy of the map, not the precision of the data that goes into it.80 This illustrates how judicial notice is not suitable, in its current form, to grapple with data-dependent technologies such as GIS. Equally absent from the conversation is an understanding of the source of errors in the GIS.

74. Id.
75. Id.
76. Id.
77. Id.
78. Id.
79. Fed. R. Evid. 201(b)(2) (stating that courts may take judicial notice of facts that are not subject to reasonable dispute because they can be “accurately” determined). The term “precision” does not even appear in Rule 201.
80. See, e.g., United States v. Lizarraga-Tirado, 789 F.3d 1107, 1109 (9th Cir. 2015) (noting that the court entered coordinates into Google Earth to see whether the results matched the image presented by the government).
Some known sources of potential error in the final product include the scale and age of data, formatting, quantitative and qualitative errors, positional accuracy, and topological errors created when information is digitized.\(^{81}\) Additionally, when multiple datasets are integrated, as is the case with Google Maps and Google Earth, there is heightened risk of propagation of errors and cascading, meaning that errors extend to multiple layers of data and skew the final GIS product.\(^{82}\) Finally, some errors are intentionally placed in datasets, either to reduce detail, or for trademarking purposes.\(^{83}\)

These concerns apply to all GIS; in fact, Google is aware of the potential for errors in its map.\(^{84}\) Provision 3 of the Google Maps Additional Terms of Service explicitly states:

Actual Conditions; Assumption of Risk. When you use Google Maps/Google Earth’s map data, traffic, directions, and other content, you may find that actual conditions differ from the map results and content, so exercise your independent judgment and use Google Maps/Google Earth at your own risk. You’re responsible at all times for your conduct and its consequences.\(^{85}\)

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81. Pascual, supra note 73.


83. This is particularly more common in data provided by commercial entities. Pascual, supra note 73.

84. On its “Help Center” page, Google explicitly invites users to “[r]eport data or content errors on Google Maps.” Google Maps Help, GOOGLE, https://support.google.com/maps/answer/3094088?sjid=14086446893406836964-NA (last visited Oct. 10, 2023) [hereinafter Google Help]; see also Max Matza, Google accused of directing motorist to drive off collapsed bridge, BBC NEWS (Sept. 21, 2023), https://www.bbc.co.uk/news/world-us-canada-66873982.amp (providing a recent example of how errors in Google Maps can produce tragic outcomes in the real world). A lawsuit by the family mentioned in the preceding citation to BBC News claims that locals in the area repeatedly attempted to notify Google that the bridge had been collapsed since 2013, evidently to no avail. Id. In response to the lawsuit, a Google spokesperson offered sympathies for the family and stated, “Our goal is to provide accurate routing information in Maps and we are reviewing this lawsuit.” Id.

Nonetheless, for many outside of the legal field, particularly those working within scientific and engineering communities, Google Maps and Google Earth have many useful applications. To address this potential, individual studies have been conducted to determine the relative accuracy of GIS. While certainly useful and often satisfactory under the standards of use of other industries, the GIS produced by Google Maps and Google Earth are not infallible. Furthermore, the extent of errors in the GIS can be greatly influenced by external conditions such as the degree of urbanization in a given area, meaning that the accuracy and precision of the GIS will be inconsistent as a user moves across it.

Proponents of admitting Google Maps-sourced evidence through judicial notice have suggested that, as a private company, Google has “a powerful financial incentive” to ensure that its maps are accurate and possesses the necessary resources to do so. The argument that Google produces reliable maps, because it is in the company’s best financial interest to do so, makes sense and is contemplated elsewhere within the Federal Rules of Evidence. This financial incentive is recognized as the justification for the business records exception to the rule against:

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On a ‘Dangerous,’ Non-Existent Trail, GIZMODO (Nov. 8, 2023), https://gizmodo.com/hiker-rescued-google-maps-dangerous-non-existent-trail-1851003343 (further evincing the potential for errors caused by outdated or incorrect data, as well as the severe consequences of reliance of that erroneous data).

86. Meghwar et al., supra note 71; Macarulla Rodriguez et al., supra note 71, at 240; Paredes-Hernández et al., supra note 71, at 589; Potere, supra note 71, at 7974.

87. Meghwar et al., supra note 71; Macarulla Rodriguez et al., supra note 71, at 240, 252–54; Paredes-Hernández et al., supra note 71, at 598; Potere, supra note 71, at 7977–78.

88. Meghwar et al., supra note 71; Macarulla Rodriguez et al., supra note 71, at 252–54; Paredes-Hernández et al., supra note 71, at 595–98; Potere, supra note 71, at 7977–78.

89. Meghwar et al., supra note 71; Macarulla Rodriguez et al., supra note 71, at 252–54; Paredes-Hernández et al., supra note 71, at 598; Potere, supra note 71, at 7977–78.

90. Bellin & Ferguson, supra note 1, at 1177.

hearsay. However, in a hearsay context, the proponent of the evidence must still authenticate it, and the record in question must withstand any challenge to its trustworthiness.

Moreover, a financial incentive is ultimately not dispositive of whether Google Maps and Google Earth are reliable. Instead, it shows Google’s motivation toward addressing inaccuracies and imprecision, which, per Google Maps’ own additional terms, are in fact possible. Users should be aware and cautious, whether they are a tourist looking for a restaurant, or a judge presiding over a criminal illegal reentry case.

D. Objectivity and the Inherent Bias of Algorithms

Just as Rule 201 fails to mention precision, it also fails to address concerns of bias. Yet, scholars highlight bias as a necessary factor in determining the propriety of judicial notice. One scholar has suggested that there is “no plausible argument that Google Maps is biased in any relevant way in its presentation of geography.” This shortsighted argument ignores the fact that Google regularly produces local versions of maps in certain countries that are “inconsistent with international consensus.” Generally, these localized versions result

92. Bryant, 562 U.S. at 392 (Scalia, J., dissenting) (“Hearsay law exempts business records, for example, because businesses have a financial incentive to keep reliable records.”)

93. See Fed. R. Evid. 901(a) (“To satisfy the requirement of authenticating or identifying an item of evidence, the proponent must produce evidence sufficient to support a finding that the item is what the proponent claims it is.”). A business record may be authenticated either by “the testimony of the custodian or another qualified witness, or by a certification that complies with Rule 902(11) or (12) or with a statute permitting certification.” Fed. R. Evid. 803(6)(d).

94. The business record in question may only be admitted if “the opponent does not show that the source of information or the method or circumstances of preparation indicate a lack of trustworthiness.” Fed. R. Evid. 803(6)(e).

95. See Google Help, supra note 84; Matza, supra note 84; Terms of Service, supra note 85.

96. See United States v. Lizarraga-Tirado, 789 F.3d 1107, 1108–09 (9th Cir. 2015).

97. Bellin & Ferguson, supra note 1, at 1176.

98. Id. at 1177.

99. Katz, supra note 6, at 90, 98.
from Google’s efforts to appease national governments whose view of borders differ from those “recognized by legitimate international deliberative bodies,” in order to avoid losing entire national markets.\textsuperscript{100} As a result, the financial incentive argued to promote accuracy implicates biases of Google’s customers in the creation of its maps.\textsuperscript{101} Google’s tendency to tailor its product by location is not unique to its GIS.\textsuperscript{102} A new tool called “Search Atlas” makes it possible to see these types of inconsistencies in the results of other Google searches.\textsuperscript{103} The failure to consider bias in privatized GIS leads courts to rely heavily on these systems and classify GIS as objectively accurate sources of

100. \textit{Id.} at 73. Google’s depiction of the border between Ukraine and the Crimean Peninsula serves as a prime example of Google’s localized versions. \textit{Id.} Most users see a dashed line acknowledging the disputed nature of the area. \textit{Id.} However, users searching from Ukraine see only a dotted line, indicating an internal border, while users searching from Russia see a solid black line, indicating that the peninsula is part of Russia. \textit{Id.} Given Russia’s invasion of Ukraine in 2022, Google’s acquiescence to nations at odds with international consensus is at best, concerning, and at worst, extremely problematic. \textit{Id.; see also} Melina Khan, \textit{Google disables live traffic conditions on Maps and Waze in Israel and Gaza}, CNBC (Oct. 24, 2023, 12:11 PM) https://www.cnbc.com/2023/10/24/google-disables-live-traffic-conditions-on-maps-in-israel-and-gaza.html?&qsearchterm=Google%20disables%20live%20traffic%20conditions%20on%20Maps%20and%20Waze%20in%20Israel%20and%20Gaza (last modified Oct. 24, 2023, 1:07 PM). Google’s decision to disable traffic conditions in Israel and Gaza coincides with an “anticipated ground invasion into Gaza” by Israel. \textit{Id.} While the Israel Defense Forces opted not to comment about its role in this decision, a spokesperson from Google confirmed it “is working with local authorities as part of the ongoing Israel-Hamas War.” \textit{Id.} Given that this is a particularly polarizing conflict, Google’s involvement in any non-neutral, non-transparent capacity is deeply troubling, especially when it impacts the composition of any version of the map.

101. \textit{Id.}


103. \textit{Id.} For example, Search Atlas has been used to show how a Google Image search for “Tiananmen Square” generates starkly different results based on location and language—the results generated by English language searches from the United Kingdom and Singapore included pictures of military vehicles and content related to the Tiananmen Square Massacre, while searches from China, or in one of the various Chinese dialects generated “recent, clean images of the historic site.” \textit{Id.} A spokesperson from Google asserted that these differences “were not caused by censorship” and added that Google “‘localize[s] results to [a user’s] preferred region and language’” to allow quick access to relevant information. \textit{Id.}
information. This behavior is particularly troubling when considering the role Google Maps and Google Earth play in cases like *Lizarraga-Tirado*, where an accurate representation of an international border is paramount to ensuring justice.104

In addition to explicit biases derived from customer relations, Google Maps is also susceptible to implicit biases by way of its own algorithms. An algorithm is a set of instructions used by a computer system to solve specific problems.105 The computer processes inputs according to the algorithm’s parameters and produces outputs.106 In the case of Google Maps, the inputs are the various types of data, and the output is the map. Additionally, Google’s algorithms utilize “machine learning,” meaning that they learn with experience to improve the system’s speed and ability to identify changes and make updates.107

These impressive capabilities lead people to mistakenly assume that these algorithms and the maps they produce are inherently objective.108 This misconception is amplified when companies market algorithms as tools capable of “remov[ing] human error and fallibility from complex decision making.”109 On the contrary, a human makes all of the initial decisions about how an algorithm identifies and sorts its information; in other words: “every algorithm reflects the priorities and judgements of its human designer.”110

But an algorithm’s potential structural biases are not the only source of error. A GIS is only as good as the data it uses to produce its map: historical biases in datasets ultimately influence a system’s
algorithmic output. In Google’s case, the risk of bias derived from data is augmented by the fact that so much of its data comes from third parties. Consider, for example, the numerosity and variability of Google’s Map Content Partners. Map Content Partners may be unequally equipped to collect and evaluate data. These differences in resources may result in differences in data quality. Likewise, different types of partners are motivated to collect data by inherently different goals, and they may account for that data differently, thus resulting in imprecision and inaccuracy. Socio-economic factors might influence how a housing developer labels individual data points, while jurisdictional concerns may influence how a municipality draws its borders. The biases of an organization may be embedded into the data that it provides. Likely, Google does not have the opportunity to search for bias in externally produced data until after that data has been algorithmically processed; at this point, subtle errors may fly below the editing team’s radar. Finally, the biases of Google’s human editors can lead to embedded errors in the final product.

Clearly, there is a risk for bias at every stage of the process—data collection, data processing, and editing the final map—and the interaction of biased data in a biased computational system may create barriers to identifying errors in the final map. Nonetheless, assumptions of Google Maps’ objectivity persist, as demonstrated by the Ninth Circuit’s decision in Lizarraga-Tirado. Courts presently operate on a presumption that, because a machine played a significant role in


112. See Legal Notices, supra note 21; Map Partners, supra note 21.

113. See, e.g., Santini, supra note 82. Santini provides the following example: aerial photograph data from a study of old growth cedar trees was used as part of a separate study of habitats for golden-cheeked warblers. Id. Although the studies have a valid relationship, the cedar data may omit critical habitats in high density areas, or alternatively, may skew the results by including areas that are uninhabited. Id. Because the cedar data was not gathered with warbler habitats in mind, it runs the risk of introducing errors through imprecision. Id.

114. See id. (discussing how bias, mislabeling, and miscalculating data can all create errors on the map that are difficult to detect).

115. Katz, supra note 6, at 83.
production, information generated by GIS will be free from the errors that the bar on hearsay and the authentication process are intended to eliminate. 116

E. Transparency in Computational Processes

Having established that Google Maps is an inherently biased system, we must examine a secondary problem. Like many other companies producing privatized computational systems, Google has largely kept all information about its map algorithms secret. 117 Although the company provides a list of data sources in its Legal Notices, it remains unclear how data from these sources is ultimately utilized. 118 The primary problem with this lack of transparency is that it means Google’s mapping algorithms are “unaudited and unregulated.” 119 This freedom from “oversight mechanisms” is troubling, given the extent to which Google Maps-sourced evidence is used both within and outside the legal community. 120

Data Scientist Cathy O’Neil 121 identifies problematic algorithms by three shared characteristics: (1) widespread and important, (2) secret, and (3) potentially destructive impact. 122 As a ubiquitous GIS, created through secretive processes, and presently used within the channels of the United States justice system, Google Maps checks all three boxes. Despite the inherent danger in relying on these secret algorithms, our

116. See United States v. Lizarraga-Tirado, 789 F.3d 1107, 1109–10 (9th Cir. 2015). (“We join other circuits that have held that machine statements are not hearsay.”).
117. Rodríguez et al., supra note 71, at 240; Nightingale, supra note 18.
118. Katz, supra note 6, at 89; see also Paredes-Hernández et al., supra note 71, at 598 (noting that “Google is reluctant to document the accuracy of their geographic products.”).
119. 99% Invisible, supra note 109, at 11:00–11:20.
120. Zalinuerte & Bell, supra note 110, at 120.
122. 99% Invisible, supra note 109, at 06:20–07:00.
society continues to place more trust in them. O’Neil attributes people’s failure to challenge the idea of “objective algorithms” to a lack of understanding. She also theorizes that “[algorithms] show up when there’s a really difficult conversation that people want to avoid.”

In the legal community, we see a lack of technical understanding in the scholarship about the admissibility of GIS and GIS data when authors conflate terms like “aerial and satellite imagery”, “GIS”, and “GPS.” Each term represents a different piece of technology with complex processes and differing levels of reliability. Google Maps is a GIS but is often mislabeled as satellite imagery or GPS technology. Both are common building blocks used in GIS, but do not individually represent the Google Maps final product. In the courtroom, the absence of critical analysis by judges is demonstrated by the widespread practice asserting the propriety of taking judicial notice of GIS-sourced evidence in a footnote. Whether inadvertent or deliberate, this tendency does, as

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123. See, e.g., id. at 7:00–9:40. O’Neil points to the criminal justice system’s use of algorithms to calculate recidivism risks as a prime example of a problematic algorithm. Id. Because these algorithms rely on historical and socio-economic data shaped by racism, the outcomes will also reflect racist principles; this is especially dangerous when considering how these algorithms can affect a defendant’s access to parole and bail opportunities. Id.

124. Id. at 11:30–11:55.

125. Id. at 12:15–12:20.

126. See, e.g., Hufstetler, supra note 9, at 859.

127. See United States v. Brooks, 715 F.3d 1069, 1077–78 (8th Cir. 2013) (finding that the district court acted appropriately when it took “judicial notice of the accuracy and reliability of GPS technology”); see also Dischinger & Wallace, supra note 3, at 21–22.

128. While some courts have engaged with the applicability of judicial notice to Google Maps in the text of their opinions, many simply assert it in a footnote, thus bypassing a meaningful discussion about reliability of this evidentiary source. See, e.g., United States v. Perea-Rey, 680 F.3d 1179, 1182 n.1 (9th Cir. 2012); McCormack v. Hiedeman, 694 F.3d 1004, 1008 n.1 (9th Cir. 2012) (taking judicial notice of the distance between cities as reflected by Google Maps); Feminist Majority Found. v. Hurley, 911 F.3d 674, 711 n.5 (4th Cir. 2018) (taking judicial notice of the location of a college campus in Fredericksburg as displayed on Google Maps); Pahls v. Thomas, 718 F.3d 1210, 1216 n.1 (10th Cir. 2013) (taking judicial notice of the location of a presidential visit as reflected on Google Maps); United States v. Burroughs, 810 F.3d 833, 835 n.1 (D.C. Cir. 2016) (taking judicial notice of a Google Map “for the purpose of identifying the area” of the defendant’s arrest); Cal. Dep’t Toxic Substances Control v. NL Indus., Inc., No. 2:20-cv-11293-SVW-JPR, 2022
O’Neil suggests, avoid several uncomfortable conversations. In particular, it circumvents questions about the way private companies gain socio-political authority by creating ubiquitous technologies, and how judicial misconceptions about jury behavior amplify the problems created by taking judicial notice of GIS technology.

III. THE COURT’S MISCONCEPTIONS ABOUT TECHNOLOGY AND JURIES

The critiques in this Comment do not argue that Google Maps, Google Earth, or any other GIS are not potential sources of incredibly valuable evidence. They have already been demonstrated to have a wealth of possible applications, both in and outside the legal system.129 Some may argue that even imperfect machines that present potentially imprecise or inaccurate information as fact remain preferable to the evaluations of imperfect human juries, whose own implicit biases and emotions can, and often do, skew the course of justice. Such an argument elevates privatized technology, and thus, privatized institutional power, above the democratic participation of the people. A careful analysis of the technology and the law demonstrates that judicial notice, with its prescriptive power, is not the appropriate framework for the admissibility of these privatized technologies. Its tendency to hide the potential for error and bias from juries is problematic.

Why, then, do judges continue the practice of taking judicial notice of these privatized technologies? Likely, as O’Neil predicts, they fail to push back against presumed machine objectivity simply because they do not understand it. Judges are primarily legal experts, most likely lacking acute knowledge about the technology making its way into their courtrooms. This is especially true given the accelerating rate at which this technology develops.130

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129. See Dischinger & Wallace, supra note 3, at 14–15; Meghwar et al., supra note 71; Rodriguez et al., supra note 71, at 240; Paredes-Hernández et al., supra note 71, at 589; Potere, supra note 71, at 7974.

130. See Reid, supra note 4 (showing a fifteen-year timeline of product expansion and evolution in Google’s mapping capabilities); see also Gupta,
Another reason that judges continue to take judicial notice of information from GIS is that judicial notice provides an enhanced level of jury control. Judicial notice lets courts control how much information parties reveal to the jury and even tells the jury exactly what finding to make when operating in a civil trial. Even in a criminal trial, where the jury need not accept a fact as conclusive, the jury is still deprived of the necessary information to adequately make an informed decision. This begs the question, why do judges feel the need to control jury behavior to such an extent?

It has been suggested that courts’ reliance on judicial notice comes from a combination of factors, namely: (1) a tendency to misunderstand the correct application of judicial notice, (2) general overconfidence by judges in their own assessment capabilities, and (3) a distrust of jury decision-making. Underlying each of these factors is courts’ desire to promote judicial economy. Although these concerns and goals stem from a well-intentioned place, judicial misconceptions about juries, judges, and the role of evidentiary rules adversely affect real-world courtroom behavior. Furthermore, the perpetuation of these beliefs, despite a wealth of empirical data to contrary, has the power to shape the functions of the legal system and all its participants.

Despite the eagerness of legal scholars to extend the practice of taking judicial notice to new internet sources, the drafters of the evidentiary rules intended that “judicial notice be the exception rather than the rule.”

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supra note 38 (breaking down how Google relies on machine learning algorithms to process data and develop its maps).
132. Fed. R. Evid. 201(f) (“In a civil case, the court must instruct the jury to accept the noted facts as conclusive.”).
133. Id.
135. Id. at 657.
139. See sources cited supra notes 11, 13.
than the rule.”

140 The evidentiary tool has a streamlining effect, but is only proper when “particular facts are outside of reasonable controversy” and possess “[a] high degree of indisputability.”

This understanding of Rule 201 would seem to suggest that when a court is faced with a complex, dynamic source of evidence, judicial notice should consistently be deemed inappropriate. Any challenge to the reliability of a source of evidence demonstrates its unsuitability for judicial notice. It follows that the use of judicial notice in these cases is a gross misapplication of Rule 201.

As discussed above, Google Maps presents a host of reliability concerns at every stage, from collecting, processing, and editing data under secretive circumstances, to producing the final map, which ultimately does not look the same on every phone. Such large room for error cannot exist within the scope of “a high degree of indisputability.” Therefore, a judge who takes judicial notice of the inherent reliability of Google Maps, either purely for judicial economy or for the purpose of jury control, is misapplying Rule 201, and straying from its true purpose and function.

The failure by judges to grapple with the complexities of a source like Google Maps or to allow the jury to make its own determination of reliability, speaks to a view that computers are inherently reliable by nature of being machines. It also speaks to the beliefs of judges as to their own abilities to assess the reliability of evidentiary sources. Judicial behavior is not the focus of empirical research to the same extent as jury behavior, but such research does exist, and shows a tendency to overestimate abilities to objectively assess information. Research also suggests that even if judges do possess assessment

140. Carter, supra note 134, at 661 (emphasis added).
141. Barger, supra note 9, at 44.
142. Fed. R. Evid. 201 (notes from the Advisory Committee); Carter, supra note 134, at 667–68 (discussing the misuse of judicial notice to determine jurisdictional elements, case complexity, and more).
143. Fed. R. Evid. 201 (notes from the Advisory Committee).
144. See United States v. Lizarraga-Tirado, 789 F.3d 1107, 1110 (9th Cir. 2015) (“We join other circuits that have held that machine statements are not hearsay.”).
146. This estimate is coupled with research regarding the overconfidence of professionals generally. Id. at 190.
capabilities superior to that of juries, judges would view the extent of this superiority at exaggerated levels.147

As it relates to admissibility of complex computer systems such as GIS, the overconfidence of judges is accompanied by a somewhat paradoxical acknowledgement. In the same breath that a judge feels that they can confidently assess the reliability of Google Maps, they may also implicitly acknowledge a lack of understanding of the complex computational and human processes underlying the system. In bypassing a meaningful analysis, judges seem to engage in the behavior described by O’Neil—because they do not understand, they do not question—and this is amplified by overconfidence in assessment capabilities. But judicial overconfidence on its own does not explain the reliance on judicial notice in addressing these matters; to fully understand that tendency, we must look to perceptions of the jury.

Although many aspects of our legal system are imperfect, juries shoulder a large portion of that criticism, and are often the focus of procedural reforms.148 The predominate fear is that “juries render irrational and unjust verdicts.”149 There seems to be an enhanced fear that jurors are incapable of judging the credibility of expert witnesses and understanding newer technologies and scientific approaches.150 Parties, courts, and legal scholars expound on the tendency of jurors to lean blindly on expert testimony without adequately considering credibility.151 In response, Brian H. Bornstein and Eddie Green, authors of The Jury Under Fire: Myth, Controversy, and Reform, suggest that although “jurors are not perfect consumers of expert testimony,” concerns raised by courts and commentators that jurors will be unduly

147. Id. at 190–91 (suggesting that judges, although likely better equipped than juries to evaluate evidence, will ultimately overestimate their abilities to evaluate evidence, such as the reliability of hearsay documents or the appropriate amount of influence to accept from expert testimony).

148. BORNSTEIN & GREENE, supra note 136, at 1–2, 309.

149. Peters, supra note 137, at 1455. See, e.g., Richard D. Friedman, Controlling the Jury-Teaching Function, 48 SETON HALL L. REV. 815, 816 (2018) (suggesting that judicial involvement is needed when “there is a plain danger that jurors may treat evidence in an illogical manner.”).


influenced by expert witnesses are largely unfounded. In fact, many legal scholars have grappled with questions of jury capabilities and there is empirical evidence that these critical portraits of juries are, to some extent, unfair. These unfair portraits, and the behavior that they inspire in judges, pose dangers beyond any specific party’s impacted claim, and ultimately harm the adversarial nature of the American legal system.

IV. Threats to the Adversarial System

It is interesting that legal scholarship continues to make the comparison between juries and judges, highlighting the differences in education, legal training, and experience as important bases for ranking adjudicative ability. This argument has merit, but neglects to consider that juries serve a greater purpose. Juries are a foundational component of our legal system and serve many functions beyond their primary role as factfinders. Jury service functions as a vehicle for political participation, provides civic education, and legitimizes the legal system for people without legal training. Obviously, these characteristics do not render juries infallible, but they highlight the true value of a trial by jury: dispute resolution informed by community values. Bornstein and Green emphasize that, as ordinary citizens, juries “represent the larger community and provide a vehicle for determining shifting social attitudes”; by comparison, decisions by magistrates “offer little insight into popular sentiment.”

By depriving jurors of this opportunity to evaluate the reliability of Google Maps-sourced evidence, courts interfere with political participation and other legitimizing functions of our legal system. Moreover, the impact of this behavior may reach far beyond the courtroom. Because of the preexisting ubiquity of Google Maps, the

152. See id. at 150–51 (providing a summary of empirical findings on how juries respond to various types of expert witnesses and testimony).
154. BORNSTEIN & GREENE, supra note 136, at 271.
155. Id.
156. Id. at 3–4, 9–10.
158. BORNSTEIN & GREENE, supra note 136, at 9–10.
159. BORNSTEIN & GREENE, supra note 136, at 10.
company already possesses “an artificial sense of sovereign-like authority.”160 When authoritative institutions, including courts, make assumptions about reliability, they influence and reinforce similar beliefs among laypersons.161 This not only creates an evidentiary issue, but it also erects a barrier to critical thought and meaningful dialogue about the role of privatized technology in our world and legal processes.162 It is just as important for juries to evaluate the reliability of complex evidence sources as it is for that evidence to be reliable. Thus, by depriving juries of this opportunity, courts diminish the legitimacy of our legal system.

The United States legal system uniquely emphasizes the adversarial process, which allows “participation of the public in the process of justice.”163 Public acceptance of the court’s authority, and of legal outcomes, is inherently rooted in the public’s ability to contribute to those outcomes.164 Even when members of the public disagree with the result of a case, the application of the adversarial process to the issue can preserve its legitimacy.165

Adversarial legal systems are defined by their reliance “on advocacy by each party” for a desired outcome, ultimately to be decided by a jury of their peers.166 A judge’s role in such a system is chiefly that of a referee, only veering into factfinder territory when overseeing a bench trial.167 In an adversarial system, “control over case presentation” is allocated to the parties.168 Each side makes choices

160. Katz, supra note 6, at 72–73.
161. See e.g., Main, supra note 85, (demonstrating how laypersons can come to believe in the infallibility of these privatized technologies with nearly fatal consequences).
162. Id. at 73.
163. Campbell, supra note 111, at 335–37.
164. Id. at 337.
165. Id. See, e.g., Tim Wu, Will Artificial Intelligence Eat the Law? The Rise of Hybrid Social-Ordering Systems, 119 COLUM. L. REV. 2001, 2022 (2019) (citing to various empirical studies, the results of which emphasize the importance of procedural fairness). These studies indicate that giving litigants a voice and treating them with respect are essential to ensuring acceptance of decisions, including those which are unfavorable to said litigants. Id.
167. Id.
about what facts to emphasize, what evidence to present to the trier of fact, and how to present that information persuasively.\textsuperscript{169} Thus, each side is given a meaningful opportunity to advocate for their desired outcome. This level of autonomy is essential to legitimizing the participatory functions of the United States legal system.\textsuperscript{170}

Of course, parties are not given unlimited power and freedom to present their case. The parties are constrained within procedural and evidentiary frameworks designed to promote a fair and effective forum for dispute resolution. The hearsay rules limit the admissibility of second-hand statements to ensure that evidence presented to the jury is reliable.\textsuperscript{171} Similarly, allowing parties to cross-examine opposing witnesses serves to “expose falsehoods, weaknesses and inconsistencies in testimony.”\textsuperscript{172} Evidentiary frameworks and rules serve many functions; importantly, they facilitate the adversarial nature of the American legal system while also ensuring that “adversary tactics [do not] hamper the search for truth.”\textsuperscript{173}

It has been suggested that, as the technologies available to the legal community expand, these procedural and evidentiary doctrines will necessarily be adapted to meet new challenges.\textsuperscript{174} This proposition marks a departure from the belief, held by some legal scholars, that existing rules can, without any adaptation, be applied to new technologies.\textsuperscript{175} It further asserts that the legislature, the judiciary, and other rule makers must approach the presence of new technology in the legal process thoughtfully, and consider in each case whether a current procedural or evidentiary rule is truly broad enough to encompass these new technologies.\textsuperscript{176} When grappling with evidentiary sources like Google Maps, it is the court’s duty to ensure that the proposed

\begin{itemize}
  \item \textsuperscript{169} Id.
  \item \textsuperscript{170} Id. at 449, 505.
  \item \textsuperscript{171} DEBORAH JONES MERRITT & RIC SIMMONS, LEARNING EVIDENCE: FROM THE FEDERAL RULES TO THE COURTROOM 444 (4th ed. 2017).
  \item \textsuperscript{172} Dufraimont, \textit{supra} note 157, at 236.
  \item \textsuperscript{173} Id. at 236–37.
  \item \textsuperscript{175} See, e.g., Barger, \textit{supra} note 9, at 70 (arguing that the existing framework for judicial notice is appropriate for internet sources, and no new rules of evidence are required to meet this new technology).
  \item \textsuperscript{176} Engstrom & Gelbach, \textit{supra} note 174, at 1004.
\end{itemize}
V. SOLUTIONS: AUTHENTICATION, STIPULATION, AND STATUTORY REVISION

In response to this threat to our adversarial system, this Comment proposes a solution with three components. First, evidence sourced from Google Maps or other similarly privatized GIS technology must be authenticated under Rule 901(b)(9) using a custodian’s testimony or other extrinsic evidence to show the system’s reliability. Second, courts may not presume that authentication is satisfied by taking judicial notice of a system’s reliability, although the adverse parties may mutually stipulate to its reliability. Third, the language of Rule 201 should be revised to reflect the issues raised by privatized technology and to better equip parties to challenge judicial notice of such technology. This approach is designed not only to address the concerns of reliability as they occur on a case-by-case basis, but also to highlight the adversarial process, and promote richer discussion about privatized technology in the courtroom.

A. Evidence Sourced From Privatized GIS Technologies Must Be Authenticated

Requiring parties to lay a foundation showing the reliability of a GIS is not a radical concept. As noted above, Rule 901 already contemplates the admissibility of evidence sourced from computational systems. Further, courts—even those who ascribe to the use of judicial notice—recognize that Google Maps presents an authentication issue. Assuming that evidence is fully authenticated without requiring the proponent to demonstrate reliability, and more importantly, without allowing the opposing party to cross-examine the system’s custodian or otherwise challenge that source, endangers the

177. See supra note 54 and accompanying text.
178. United States v. Lizarraga-Tirado, 789 F.3d 1107, 1110 (9th Cir. 2015).
legitimacy of a trial’s outcome. In allowing the opposing party to cross-examine the custodian, the court ensures that the party can make a meaningful challenge to the system’s reliability and admissibility, which the jury may then weigh in reaching its verdict. By letting the jury make such an evaluation, the court furthers the participation value of our legal system and promotes its legitimacy.

B. Mutual Party Stipulations Will Satisfy the Needs of Judicial Economy

Additionally, the authentication framework suggested here would accomplish its goals without hindering judicial economy. Most parties will likely be willing to stipulate to the reliability of these GIS technologies. This will achieve the same level of efficiency that is attained when courts take judicial notice, while still allowing party control and participation that are uninhibited by judicial authority. Because the presumed reliability hinges on mutual agreement by both parties, it preserves a party’s right to make meaningful arguments about why a GIS is not sufficiently reliable and why the jury should not give related evidence significant weight. Thus, shifting the emphasis from judicial notice by the judge to stipulation by parties ensures mutual party control over decisions related to advocacy and emphasizes the participatory nature of the broader adversarial system.

C. The Statutory Language of Rule 201 Must Be Revised to Correct Harmful Precedent

Finally, because relevant caselaw already asserts judicial notice as the appropriate evidentiary framework for facts sourced from Google Maps, and because many trial courts have exhibited a readiness to accept it as such, alternative legal guidance is necessary to prevent

179. See supra note 49 and accompanying text. Before introducing evidence sourced from a computational system, a party must introduce evidence of the system’s reliability. FED. R. EVID. 901(b)(9). As an out-of-court statement introduced to prove the truth of the matter asserted, a mere affidavit attesting to this reliability would likely be barred as hearsay, necessitating live testimony from a custodial witness. See FED. R. EVID. 801, 802. By cross-examining the proponent’s custodian, the opposing party can demonstrate to the jury that the system in question is not reliable, and evidence sourced from it should not be believed.
This Comment suggests a revision to Rule 201, in order to better reflect its limitations when dealing with privatized GIS technology. That said, any revision to the rule’s language must be tempered by our inability to perfectly gauge the often unpredictable evolution of technology. The reach and user-capabilities of a technology like Google Maps will likely expand in the coming decades or even years. It makes little sense to tailor laws and rules to specific technological capabilities when those capabilities are certain to change.

However, there are other, more longstanding characteristics which may be at stake in any given technology. This analysis has highlighted several characteristics not explicitly addressed in the language of Rule 201, but that continue to greatly impact the reliability of Google Maps, and other privatized GIS, even as technology advances. Thus, it is crucial to reframe this as an issue of overreliance on privatized technologies in the legal system and to account for the limitations of these technologies in the statutory language.

This Comment identifies two sections of the rule where language should be revised. First, this Comment suggests revising Rule 201(b)(2), which has been identified by various courts as the specific vehicle for taking judicial notice of evidence sourced from Google Maps. This Comment suggests that the statutory language be changed as follows:

(b) Kinds of Facts That May Be Judicially Noticed. The court may judicially notice a fact that is not subject to reasonable dispute because it:

(1) is generally known within the trial court’s territorial jurisdiction; or
(2) can be accurately and readily determined from [transparent, reliable] sources whose accuracy [and precision] cannot reasonably be questioned [or challenged on account of bias].

180. See cases cited supra notes 58, 60, 61, 128.
181. Engstrom & Gelbach, supra note 174, at 1042 (noting that the speed at which technology evolves and the direction that its evolution takes are often unpredictable).
Adding “precision” to the rule highlights the need for courts to better understand the different layers of reliability. This Comment’s proposed revision also recharacterizes the appropriate sources as “transparent” and “reliable.” Because many of the companies creating algorithms and utilizing machine-learning maintain high levels of secrecy, it is impossible to establish the requisite indisputability of a source, making judicial notice a completely inappropriate framework for admissibility. Only when a source is sufficiently transparent, thus allowing courts to fully understand its processes, can its reliability be ascertained to the extent that it warrants judicial notice.

Further, the inclusion of language addressing bias is intended to draw attention to the privatized nature of technology and to firmly challenge the notion that Google’s financial incentives ensure an error-free product. As a private company, Google is incentivized to increase its profits and maintain its ubiquity as the layperson’s GIS. These incentives create explicit and implicit biases in its map-making process. By creating a bias-specific challenge, this revision categorically blocks the admission of privatized technologies by judicial notice. To better facilitate this, this Comment also suggests the following addition to Rule 201(e):

(e) Opportunity to Be Heard. On timely request, a party is entitled to be heard on the propriety of taking judicial notice and the nature of the fact to be noticed. If the court takes judicial notice before notifying a party, the party, on request, is still entitled to be heard. [(1) If a party challenges the reliability of a source on the basis of bias or lack of transparency, the court may not take judicial notice of the pertinent fact without corroboration by an alternative source.]

A fact which is only presented by one source is subject to reasonable dispute, especially when it is unclear how the source produced that fact. Therefore, the requirement of verification of facts by alternative sources with transparent processes, and without the biases presented by the original source, should eliminate the use of judicial notice in these instances. The added language also provides attorneys with a clearer understanding of how they may effectively challenge judicial notice, when neither they, nor the judge, have access to a source’s internal process for generating results. By establishing this additional basis for a challenge, this suggested revision emphasizes the truth-seeking function of legal dispute resolution and provides yet
another opportunity for judicial notice to be displaced by a more adversarial approach to evidentiary matters.

Beyond impacting courtroom processes, the Author of this Comment hopes to expand the legal discussion about privatized technology. In a conversation dominated by concerns about the constitutional right of privacy, few participants are looking at the dangerous implications of placing privatized technologies on a pedestal. By upholding these technologies as objective and reliable sources of accurate information, without understanding where that information comes from and how it is manipulated, judges and scholars delegate an inappropriate authority to the companies producing them. This, in turn, influences the beliefs of the broader legal community and society as a whole. Only when the legal community actively engages with and learns about these technologies can it be sure of their appropriateness as tools in our legal system; that process begins in our discussions about admissibility.

CONCLUSION

Adversarialism sits at the heart of our judicial system. This system’s legitimacy rests upon community participation, which generally manifests as party-controlled advocacy and legal outcomes determined by juries. The improper judicial notice of GIS systems undermines these very principles.

In a world increasingly infiltrated by privatized, data-driven technology, the legal community cannot afford ignorance or complacency. We must take active steps to understand technologies before we let them steer the wheels of justice. Privatized GIS technologies like Google Maps present enormous potential to help resolve legal disputes. Nevertheless, the secretive processes of Google, the biases inherent in those processes, and the potential for imprecision and inaccuracy in Google’s final product suggest the need for an evidentiary framework which accounts for these flaws and allows the factfinder to weigh them in making determinations. Courts’ misconceptions that technology can be relied upon as infallible, and that human factfinders are to be distrusted, threaten the foundations of our legal system.

This is exemplified by courts’ admission of evidence sourced from Google Maps by way of judicial notice. It is integral to adversarialism that parties be given adequate opportunities to challenge evidence
produced by privatized technology. Moreover, it is essential that juries consider these challenges to promote the participatory function of our legal system, contributing to its legitimacy. Only by requiring parties to undergo the authentication processes (while acknowledging that party-driven stipulations can exemplify judicial economy) can the adversarial nature of our system be preserved. Furthermore, the language of Rule 201 contains flagrant gaps. Revisions are necessary to thwart harmful precedent and promote active, critical analyses of the role of privatized technology in the legal system; a topic which will only grow more significant in the decades to come.

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