Selling the Conceptual and Computational Value of Esri's ArcGIS Platform

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Abstract: At a time when industries are struggling to monetize the diversification of information flows in the digital economy, the transition from a "software as a service" model to a platform takes on crucial importance. Platforms are complex technological infrastructures that host and exchange content, but they are also sites of cultural interaction, consumer-driven business models, and powerful metaphors driving the digital economy. Situating Esri's ArcGIS platform within the Facebook-era of platform development offers ways of understanding how one of the world's largest GIS innovation companies and therefore other market dominators deploy popular platform thinking into its business and marketing strategies, while at the same time adoption technological standards that are conducive to both consumers and profit-seeking activities. Under examination are branded appeals to user value and strategies to create the optimal market for platform adoption by making data platform ready. Esri's long-term support of the Open Geospatial Consortium (OGC), an international non-profit organization set to standardize geospatial data is one such social relation discussed. Considered are the democratic promises and practices that metaphorically hide the move towards "platform capitalism," where monopolies of the market structure the use and types of data being produced, distributed and consumed.

Keywords: GIS, platform studies, branding

Platforms gained notable momentum as a central theme in tech news and buzz circulating around software developers in 2012. Along with other popular conceits such as the "sharing economy," industries struggling to find ways to monetize the diversification of information flows in the digital economy deemed platforms the "next big thing" for economic survival.[1] In the summer of 2012, Esri, a premier global supplier of geographic information systems (GIS), also transitioned its widely used ArcGIS software into a platform technology to "empower" user sharing and collaboration with geospatial tools and data. In technical terms, a platform involves an infrastructure of hardware and/or software upon which other technologies and applications can be developed or run. Computer operating systems are platform technologies. There are also commercial, marketing, social networking, and video game platforms. A well-known example is Google, which started in 1998 as a straightforward search engine and became a platform when it added Gmail, Maps, Docs, YouTube and so on to its services. In terms of function, Google's platform matches the supply and demand of online content. Uber, eBay, and AirBnB are platforms that coordinate the supply and demand of products and services. Esri's ArcGIS matches clients with spatial tools and data.

Platforms are complex technological infrastructures that host and exchange content, but they are also sites of cultural interaction, consumer-driven business models, and powerful metaphors driving the digital economy. Or as Tarleton Gillespie (2010) argued, "platforms are platforms not necessarily because they allow code to be written or run, but because they afford an opportunity to communicate,

interact, or sell.”[2] Platforms reflect an outgrowth of what Adrian McKenzie (2008) forecasted of software trending towards the social, sparking the need for social analyses that stemmed beyond software as a technical device to software as a product and a process.[3] In particular, examining how code mediates interactions between everyday coding practices, software vendors, investors, and government seeking to promote and legitimate these activities.[4] Rob Kitchin and Martin Dodge (2011) similarly noted a need to study the use of media, marketing, and advertising by vested interests to understand the production of discursive regimes and a logic shaping software development and reception.[5] Rather than focusing on software/code specifically, this paper responds to earlier requests in software studies for a political economy of software, or more specifically of platforms.

Platform studies, which offers a set of approaches in media studies to break down the complexities between platform culture and the technical specifics of the computing devices and software environments, similarly calls for a focus on participatory media practices that influence the content being produced and consumed.[6] While necessary to understanding internal relations, micro-focused studies on networked communities and technics often appear autonomous from the transnational reach of consumer capitalism and the sovereignty of nation-states over citizens.[7] Of equally needed assessment are the influencing governance of a growing class of globally operating digital gatekeepers who control the technological parameters of that content production, distribution, and consumption. That is, understanding the platform as a business model and strategy driving out competition in the internet marketplace under a header of openness and marketplace democracy. It is a direction termed “platform capitalism,” which hails from a critique by Sascha Lobo, a German technology blogger writing for *Der Spiegel* in 2014. Platforms, Lobo argued, enable companies to reach a monopoly position in a respective market by opening access.[8] What platforms sell is a society indistinguishable from the market, where the means of production is dispersed and accessible and a powerful set of digital intermediaries aim to connect supply and demand to facilitate the citizen producer.

Situating Esri’s ArcGIS platform within the Facebook-era of platform development offers ways of understanding how one of the world’s largest GIS innovation companies and therefore other market dominators deploy popular platform thinking into business and marketing strategies, while at the same time adopting technological standards that are conducive to both consumers and profit-seeking activities. Under examination are branded appeals to user value and networking strategies to create the optimal market for platform adoption at a time when the GIS market is plagued by inconsistent standards. Esri’s long-term support of the Open Geospatial Consortium (OGC), an international non-profit organization set to standardize geospatial data is one such social relation discussed. These activities begin to render visible the pervasive set of discourses and practices involved and to ask how technical specifications thought to aid alternatives to enter the market only further possibilities for powerful players to expand platform activity by making more (geospatial) data platform ready.

Platforming Geography

Platform studies often examines the competing or dual natures of commercial platforms that afford users a base for creativity and innovation, but constrain or channel a user’s participation into a company’s for-profit activities. This is where the notion of “sharing” in the “sharing economy” gains part of its irony. Sometimes referred to as the “shareconomy” or “collaborative consumption,” the sharing

economy is an umbrella term hailing the democratic potential of peer-to-peer sharing in the creation, production, and distribution of goods and services. As Lobo and later critics remarked, the notion of “sharing” in a sharing economy downgrades the complexity of “network culture,” disavowing the presence of diverse market transactions where users are also seeking to profit.[9] Platforms create a class of user producers who control the value created within the platform, while platform owners seek for ways to unobtrusively tighten the conditions under which that value is created. The result is a growing tension between profit seekers in a growing and shifting platform economy.[10]

Similar schisms arose with the onset of Web 2.0 and the seeking of user-generated content from social networks in the hopes of “harnessing collective intelligence.”[11] Companies talked of “putting the We in the Web” and embraced granting consumers greater influence over decisions that impacted the production and distribution of media culture.[12] Imperfectly aligned interests between producers and consumers eventually forced media industries to adjust their practices. This included developing new conceptualizations of its user-consumer market, and strategizing how to court consumers and generate value from them.[13] Digital industries are displaying a similar oligopolistic system of control as the media industry, and are undergoing similar processes of user reassessment.[14] Discursive work in the realm of marketing and public relations and its broad appeal to users, clients, advertisers, and policymakers, highlights this growing need to control the framing of platform services and technologies, especially under increasing legal responsibilities.[15] Unsurprisingly, technology companies Apple, Google, Microsoft, and Facebook make up four of the top five of the world’s most valuable brands, and each spend billions on company advertising every year.[16]

Reflecting the need for conscious framing of the platform as a business model is Applico, a small, New York-based consulting firm trademarked as the world's first “Platform Innovation Company.” Aiding businesses in developing a successful platform technology, Applico’s publicly available consulting advice is heavy in business rhetoric but light in technological practice. A solid technological base is required to enable some form of value-creating exchange to take place, but a thriving platform as Applico details, depends on fundraising, business development, and branding.[17] Brands were once considered a minor device of managerial control, but grew to become the most valuable component of corporations.[18] An established brand associates a product with an idea or concept and trademarked name, which serves to fix in consumer's minds that commodities or in this case, data and software, come from companies that offer more than just technical services.[19] These powerful ideological devices are used to establish tangible networked relations among important stakeholders. That is, brands “act” in the world through branding practices which are mediated processes of communication and autonomous acts of interaction among employees, clients, and consumers that enhance the productivity and potential of these concepts to circulate beyond company doors.[20]

Branding a platform is considered unique compared to traditional strategies because of what Applico defines as a lack of control the company has over user experience.[21] A platform creates a “multi-sided market” or more appropriately, a “multi-sided platform” (MSP), enabling interactions and therefore the brand to disperse between interdependent groups of users, software developers, advertisers, and so on.[22] Rather than product-driven, to brand a platform is to have a consumer-driven focus, starting with “deciding who are the relevant groups of customers for the MSP and the fundamental services the platform needs to perform for those customers are critical to an MSP’s success, even before it is launched and priced.”[23] As Applico explains, a platform brand needs to explain

"succinctly and convincingly" the platform's utility or purpose in order to convince customers to adopt what can be seen as "disruptive" behaviors.[24] For instance, containing compelling reasons for users to start using an app for peer-to-peer ride sharing through the platform Uber rather than dialing a traditional taxi or shuttle service. If the platform makes it through a successful incubation period, which is the time needed to transition to a new practice and to solidify a platform's place and potential in the market, branding enters an "aspirational" stage where its purpose or goal is defined and can be continuously reified.[25]

True to a consumer-driven model, a platform's aspirational brand emphasizes user actions assisted by the platform rather than the company's intervention. Facebook's user-focused motto is "Connect with friends and the world around you on Facebook," and the company encodes this mission into all its subsequent branded endeavors while leaving out its for-profit activities involving third-party advertisers. The GIS company Esri defines its ArcGIS platform along these ambitious lines: "It's a platform. A platform we can use to turn simple geography and location into something more powerful and meaningful - geographic understanding. We use this platform to discover the how and why from the where, and to share and communicate that knowledge with others." [26] ArcGIS software allows users to store, analyze, and map data in a proprietary format. The ArcGIS platform goes further by giving users the ability to connect, understand, communicate, and share, or essentially apply geography. Esri's President Jack Dangermond designated it "geography as a platform," where "the role of geography is a platform for understanding the world," thus making the technology and the traditional practice one in the same.[27]

The term "platform" is the conceptual glue that holds the semantic chops to metaphorically elevate the user's actions, or in Esri's case, the actions of the GIS community. The etymological origins of the word date back to the French *plateforme*, meaning "ground plan" or literally "flat shape." This figurative emphasis is of a human-built or naturally-formed physical space, or as the architectural definition states, "a raised surface on which people or things can stand." [28] Its vernacular ubiquity is "specific enough to capturing life in an enclosed, commercialized and managed realm," while also encapsulating what is an understood norm of cloud computing, social networking, smart phones and apps, and the shift from desktops to tablet computing.[29] Conceptually, it cues a space for user action where "the material platform for physical industry becomes a metaphysical one for opportunity, action, and insight." [30] In order for a company to increase trade and profits, it needs to expand its fantasies beyond company doors and convince investors, enterprise customers, and user-consumers of the unthreatening economic and social benefit of using the platform space to engage with geospatial technologies, data, and content.[31] CEO Dangermond's rhetorical confidence thus rests in the GIS community to "better harness the power of GIS maps to engage everyone, telling the stories of what's happening to the world and creating maps that create a better future, a future with better outcomes" and it is the new platform that he says "allows geographic knowledge to be widely shared, enabling widespread access and use of GIS." [32]

Esri's public relations maintain that central to its move to a geospatial platform was to provide the same great tools, but with greater user value. The GIS company began in 1969 as a land-use consulting firm, carrying out service work projects before transitioning in the 1980s and 90s to providing customers with software tools and products. This represents a "pipe" form of business, where a company has one or more closely related products or services. Firms that build physical assets, provide

services, or create technologies sell them down the pipeline to customers. Value is produced upstream, and consumed downstream. For instance, all manufacturing, television and radio, and education are considered a pipe form of consumption. From the 1990s onward, Esri established a partner network and focused on supporting partners by expanding its products' capabilities. This product-driven focus led to ArcGIS becoming a Software as a Service (SaaS) or cloud application service, using the web to deliver applications the company manages, but whose interface is accessed on the client's side. The geospatial industry's adoption of HTML 5 as a preferred technology for online mapping, along with open-source and cloud-based GIS, expanded the possibilities and profitability of the company's next endeavor with an open and extendable platform.

Understood as a Darwinian imperative to survive in a given market of competitors, one way industries seek to gain advantage over competitors is by convincing clients that their company is the most cost-effective and cutting-edge.[33] Platform buzz alludes to this construction. As the company touts, the ArcGIS platform is "open, configurable, fast, and efficient" so "anyone" can share spatial information and use the infrastructure for one or more applications that serve their needs.[34] Web GIS connectivity opens and extends the platform's use to GIS experts and those working outside GIS departments, forming what is popularly termed an "ecosystem" around the technology. The ecosystem facilitates a smooth "value-creating interaction" between two or more groups who otherwise had no simple access to each other. These developers, partners, users, and collaborators, who could be private individuals or multinational corporations, can then organize and share spatial information among groups or across divisions of organizations, and between organizations and the public. But the "anyone" most valued by the company are developers who make development, testing, and deployment of applications quick, easier, and cost-effective. Product-driven strategies do not fall by the wayside but are arguably enhanced by developer's innovation as they are expected to create applications dependent on the platform, while also adapting those programs to needs and communities beyond what original developers could have contemplated. In this way, platforms encourage diversification of a company's inventory and reduce risk if a downfall of the market occurs. It also gives leeway for the company to exploit the labor conducted within the platform to cost-effectively increase innovation, making them more cutting-edge.

Praising the innovation and creation possibilities of the platform user is akin to the democratizing hype of Web 2.0, which turned consumers into producers. It is a conceptual pandering where the platform "suggests a progressive and egalitarian arrangement, lifting up those who stand upon it." [35] But as with tensions experienced over harnessing collective intelligence, a platform induces questions over content ownership. Esri still manages the online subscriptions, servers, storage, networking, and the software itself, but to the client, the open and accessible infrastructure "erases" the middleman so the exchanges taking place upon it appear "simpler and fairer." [36] The fine print of Esri's Terms of Use for developers specifies that ArcGIS Online Plan account customers can build applications for internal use and can make their app available to anyone. They can leverage and integrate ArcGIS APIs and SDKs with other technology, web services, and applications, and importantly create applications of their own, but they cannot monetize their app by charging a fee or embedding advertising in it. Nor can clients remove any logos or trademarks when using Esri's services.[37] While the platform is of immense user utility, internal innovation is owned, Esri's brand is extended, and if the company can find what developers will pay or what will encourage them to build applications that are dependent on the

platform itself, a monopoly position in the geospatial market can be created and maintained. Branding helps establish this trust.

Platform Ready Geospatial Data

The platform's consumer-driven business strategy plays out conceptually in the realm of marketing, but also computationally, where technological standards complement the discursive power wielded. In particular is a platform's ability to be programmable. A blog post written in 2007 after the launch of the Facebook Platform by Netscape founder Marc Andreessen, solidifies the computational importance of platforms by flatly outlining: "If you can program it, then it's a platform. If you can't then it's not." [38] During this time, major web businesses were releasing APIs, but outside-only interactions lacked the programmability and customizability needed to be true platforms. [39] Andreessen thus praised Facebook as "a dramatic leap forward for the Internet industry," bringing an end to "walled gardens," or former proprietary online services such as America Online, and bringing about a "more sophisticated" "distribution engine" that promises "economic freedom" to third party applications that can easily run ads and sell products and services in the platform. [40] Programmatic access was also advanced as a viable business strategy by Tim O'Reilly in his Web 2.0 manifesto, arguing that making APIs and content open for reusing, remixing, and "hackability" added value to the platform by building new services on top of it. [41]

Despite acknowledged importance of programmability as an underlying logic of social media as well as new media in general, research on computational understandings as opposed to conceptual meanings driving platform adoption remains a novel line of critique within platform studies. [42] Concerned with the computational stakes, Anne Helmond's (2015) study on platform programmability importantly brings focus to this blind spot. Helmond calls the rise of the platform as the dominant economic and infrastructural model of the social web, "platformization." Specifically, it involves the decentralization of platform features into the web and a recentralization of "platform ready" data. Helmond conceptualizes a platform's programmatic access in terms of Alan Liu's (2004) understanding of "data pours," or as pouring data systems that flow data to third parties. These channels which flow between third parties and social media platforms make external web data platform ready. [43] The data is further operationalized through "platform-native objects" such as APIs, social plug-ins, and the Open Graph, which Helmond states, "connect the infrastructural model of the platform to its economic aims." [44] These aims include the commodification of the web and of app content and user activities.

While return on investment (ROI) is critical in technology selection, it is a slow realization in GIS and the geospatial sector as it transitioned from governmental or regulated environments to for-profit enterprises. Geospatial data is not platform ready because it is plagued by both the cost of integrating vast databases of location-relevant data and a substantial lack of technological standards to ensure that the metadata of structured and unstructured content can be leveraged by a wide array of users. Technological standards are established norms or uniform criteria regarding the engineering aspects of implementing technical systems or in the case of geospatial data, for interfaces and encoding specific to geoprocessing and geospatial interoperability. [45] The lack of geospatial standards hindering the facility of geospatial data integration are vast including those supporting privacy rules related to location, consistent service level agreements, policies and agreements on the use of standards, and internationally agreed upon semantics for user domains. Furthermore, the rise in competing standards

being implemented for similar interoperability problems causes issues with cloud computing and shared resources, as well as disagreements over architectural patterns on which to build an expanding geospatial web.[46]

The geospatial web or “geoweb” initially referred to spatially-referenced web content and the use of organizing the Internet with geographical information.[47] Prior to the era of internet mapping, digital cartography required specialized GIS software and access to government data, while exorbitant costs, complex technical architectures, and strict copyright hindered the reuse of maps.[48] Applications such as the Google Maps API turned mapmaking and spatial data collecting from the exclusive hands of governments and experts into an everyday practice and maps into “programmable objects.”[49] The geoweb expanded with the Google platform, increasing everyday mapmakers and currently references newer forms of spatial data, practices, and hardware and/or software that facilitate creating and interacting with location-based content on the web.[50] It is composed of an ecosystem of data providers, location-enabled device manufacturers, app creators, satellite and aerial imagery services, experts, GIS practitioners and so on enabling the transmission of information. The geoweb’s expansion makes mapping technologies and location data a powerful commodity and global economic force. In 2012 during the platform buzz and Esri’s transition from a SaaS to a platform, the GIS market’s impact on the U.S. economy was already projected in the billions.[51] With millions of connected consumers in the U.S. alone all accessing geospatial information on their computers, mobile phones, tablets and GPS devices, corporations swiftly acknowledged the profit-making potential of linking business, consumer information, and geographically correlated information despite the struggles measuring ROI.

Programmability affords platformed opportunities “to communicate, interact, or sell”[52] while the development of technical standards seeks to improve access and interoperability for “anyone” to do so. Promoting geospatial interoperability is the expressed goal of the Open Geospatial Consortium, founded in 1994. The OGC is currently composed of over 500 commercial, governmental, nonprofit and research organizations tasked with deciding on the technical specifications for the open standards of geospatial content and services, GIS, data processing, and data sharing. Its vision as a global industry consortium is to “achieve the full societal, economic and scientific benefits of integrating electronic location resources into commercial and institutional processes worldwide.”[53] The business processes that make the geospatial web a profitable place are an integral part of this equation and are outlined in each of the five goals of the OGC’s vision.[54] In particular, the OGC seeks to support “the formation of new and innovative markets and applications for geospatial technologies” by making standards openly available and free to the market. Along with the core values of integrity, excellence, collaboration, and empowerment, good stewardship directs OGC efforts into ways to “effectively manage and maximize the return on investment provided by members and partners.”[55] The adoption of open standards arguably makes it easier for enterprise companies to enter the market, and gives agencies more choice when buying software that will work on different systems. The OGC focuses on standardizing interface and encoding standards to make this happen.[56]

If technology is shaped by and shapes society, standardization of technology is assumed to present institutional opportunities to incorporate social and political values into the design process.[57] Often standards emerge and diffuse through market processes to become obligatory for respective companies to adopt. In the GIS market, if one private company with private data standards leads the market for GIS products, it limits the viability of other companies with alternative standards.

Entrepreneurs end up adopting the dominate standard in order to enter the market. Esri for instance holds over a 40 percent share of the GIS global market, and its software is used by two-thirds of the Fortune 500 companies, giving it considerable clout over standards adoption.[58] The OGC's institutional arrangement of non-profit collaboration, negotiation, and consensus building which conform to the basic principles of democracy is poised and praised to inflect a more open and transparent context for standards development and adoption.[59] The process is compatible with a realm of innovation involving networks and services under the more or less democratic metaphor of the "Information Society." [60] The OGC's motto is "to improve sharing of the world's geospatial data," and it complements not only the popular suppositions of the "sharing economy," but Esri's marketing of its ArcGIS platform. That is, the OGC's brand also conceptually panders to what businesses claim a platform technology promises, greater user value.

The creation of Esri's optimal platform market arguably started back in 1999, when the company was granted its first OGC compliancy certificates. Esri became a main supporter of the OGC and would immediately integrate its standards into its base platform. Esri infuses societal ideals into its aspirational brand and true to branding practice, collaborates with like-minded organizations to continue convincing investors, enterprise customers, and user-consumers of the economic and social benefit of geospatial technologies, data, and content. This is not new. The active agent of the consumer that the platform highlights was one that in the 1960s, capitalist corporations learned to embrace and co-opt into a marketing regime that valorized change, individuality, novel experiences, and creativity.[61] Corporations incorporated the cultural categories and frameworks of society, packaged them in with their agenda setting and structure of their products, while giving consumers the leeway to make meanings from the signs and symbols on offer. Brands valorize and impart value on products, but with brands linked to lifestyles, politics, and even social activism they can shape consumer habits as well as political, social, and civic participation.[62]

Esri's relationship with the OGC is not to discursively complement its brand alone, however. Standardization by committee does not guarantee a more democratic technology, but it can guarantee a more successful platform. In the digital economy, platforms that are successful adhere to open standards. This is because true to democratic design, standardization of software reaches a wider acceptance and use of the resulting application. It is more open to "anyone," even at the expense of replacing what is considered the de-facto standard of the Esri shapefile. Esri, for instance, actively participated in the development and supports the ArcGIS use of OGC's GeoPackage, an open, standards-based universal file format for geodata that includes vectors, raster maps, extensions, and matrix sets. [63] Increased interoperability of a "one file for everything" format is more efficient for external code development and extends into more value creating interactions such as software development. What makes geospatial data platform ready is thus both parts programmatic access and marketing of consumer-driven business models.

Conclusion

Esri's "platform for geographic understanding" is one of the many industrial practices, technologies, discourses, and interactions that inflect, reenact, and perpetuate continuing trends in the digital economy, and political and economic structures more broadly. The aspirational brand and branding practices promoting the ArcGIS platform reflect how companies continue to deal in the same

rhetorical fantasies of marketplace democracy that have long been pumped into selling technologies to clients and the general public alike. The resultant apoliticization encourages a need for more critiques of the business and computational practices to render visible the neoliberal power structures of governance at play in selling digital products and services. It further serves as a reminder that the growth of digital empires depends on sustained public and private-sector cooperation and partnership. Data collection and dissemination require government support for the constellation of satellites that generate mapping and imaging data that the industry's output depends on, while clear and open policies governing location-based data facilitate the increasing flow of information to businesses and commerce, and ease user adoption. While initiatives and businesses exist that are using digital platforms to produce exchanges true to the meaning of "sharing" with no monetized market exchange at play, the same democratic promises are ethically charging the move towards platform capitalism.

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[2] Gillespie, "The Politics of 'Platforms.'"

[3] Adrian McKenzie, "Internationalization," in *Software Studies: A Lexicon*, edited by Matthew Fuller (Cambridge, MA: MIT Press, 2008): 155; 247.

[4] *ibid*, 255.

[5] Rob Kitchin and Martin Dodge, "A Manifesto for Software Studies," in *Code/Space: Software and Everyday Life* (Cambridge, MA: MIT Press, 2011): 251.

[6] Ian Bogost and Nick Montfort (2009) define platform studies as "the study of how our technologies, our computer platforms, embody particular cultural concepts and ideals, how they too are created in a cultural context;" ("Platform Studies: Frequently Questioned Answers," *Digital Arts and Culture* (2009)). Research in this field includes an expanding core of interrogation of the use of "platform" as a concept (see Tarleton Gillespie, "The Politics of 'Platforms,'" *New Media & Society* 12 (2010): 347-364; Fenwick McKelvey, "A Programmable Platform? Drupal, Modularity, and the Future of the Web," *Fibreculture* 18 (2011)), analyses of "technological logics" (see Ganaele Langlois, Fenwick McKelvey, Greg Elmer, and Kenneth Werbin, "Mapping Commercial Web 2.0 Worlds: Towards a New Critical Ontogenesis," *Fibreculture* 14 (2009); Ganaele Langlois, Greg Elmer, Fenwick McKelvey, and Zachary Devereaux, "Networked Publics: The Double Articulation of Code and Politics on Facebook," *Canadian Journal of Communication* 34, no. 3 (2009); Carolin Gerlitz and Anne Helmond, "The Like Economy: Social Buttons and the Data-Intensive Web," *New Media & Society* 15 (2013): 1348-1365), and architectural influences (see Jose van Dijck, *The Culture of Connectivity: A Critical History of Social Media* (New York, NY: Oxford University Press, 2013)), as well as object-focused studies on video gaming systems and design (see Nick Montfort and Ian Bogost, *Racing the Beam: The Atari Video Computer System* (Cambridge, MA: MIT Press, 2009)), content providing websites such as YouTube and Facebook (see Gillespie, "The Politics of Platforms;" Anne Helmond, "The

Platformization of the Web: Making Web Data Platform Ready," *Social Media + Society* 1, no. 2 (2015): 1-11), and social media applications such as the Twitter API (see Taina Bucher, "Objects of Intense Feeling: The Case of the Twitter API," *Computational Culture* 3 (2013)). The bulk of research delves into commercial platforms, which offer the richest site of content production, distribution, and consumption, and often the most visible in terms of cultural trends and legal conflicts. Gillespie (2017) defines commercial platforms as "sites and services that host public expression, store it on and serve it up from the cloud, organize access to it through search and recommendation, or install it onto mobile devices;" (Tarleton Gillespie, "Governance of and by Platforms," in *SAGE Handbook of Social Media*, ed. by Jean Burgess, Thomas Poell, and Alice Marwick (New York: SAGE, 2017)).

[7] See David O'Sullivan, "Geographical Information Science: Critical GIS" *Progress in Human Geography* 30, no. 6 (2006), 783-791; Agnieszka Leszczynski, "Situating the Geoweb in Political Economy," *Progress in Human Geography* 36, no. 1 (2012), 72-89; Matt Wilson, "Location-based Services, Conspicuous Mobility, and the Location-Aware Future," *Journal of Transport Geography* 34 (2014): 297-299; and Jim Thatcher et al., "Revisiting Critical GIS," *Environment and Planning A* 48, no. 5 (2016): 815-824.

[8] Olma, "Never Mind the Sharing Economy: Here's Platform Capitalism."

[9] *ibid.*

[10] For example, the Web 2.0-era online content provider and platform YouTube induces friction between user-generated and commercially produced content, between selling advertising space and building and maintaining a user community, and between intervening in a user's content or remaining neutral (see Gillespie, "The Politics of 'Platforms'").

[11] Tim O'Reilly, "What is Web 2.0," *O'Reilly Network*, September 30, 2005, <http://www.oreilly.com/pub/a/web2/archive/what-is-web-20.html>.

[12] Levy, Steven and Brad Stone. "The New Wisdom of the Web." *Newsweek*, April 3, 2006, <http://www.newsweek.com/id/45976>.

[13] Joshua Green and Henry Jenkins, "The Moral Economy of Web 2.0: Audience Research and Convergence Culture," in *Media Industries: History, Theory, and Method*, ed. by Jennifer Holt and Alisa Perren (Malden, MA: Wiley-Blackwell, 2009), 215.

[14] See Ben H. Bagdikian *The New Media Monopoly* (Boston, MA: Beacon Press, 2004) and Robert W. McChesney, *The Problem of the Media: U.S. Communication Politics in the Twenty-First Century* (New York: Monthly Review Press, 2004).

[15] Gillespie, "The Politics of 'Platforms.'"

[16] Kurt Badenhausen, "Apple, Google Top the World's Most Valuable Brands," *Forbes*, May 31, 2016, <http://www.forbes.com/sites/kurtbadenhausen/2016/05/11/the-worlds-most-valuable-brands/>.

[17] Erik Zambrano, "How Branding Is Unique For A Platform (Two-Sided, Network, Marketplace) Business," *Applico*, January 7, 2016, <https://www.applicoinc.com/blog/branding-unique-platform-two-sided-network-marketplace-business/>.

[18] In the late 1980s, Jean Baudrillard put forth a model of mutual dependence of production and consumption that emphasized the consumer as an active agent in shaping consumption, social relations, and identities ("Simulacra and Simulations," in *Jean Baudrillard, Selected Writings*, ed. by Mark Poster (Stanford: Stanford University Press, 1988), 166-184). Similar to a ritual process, consumer culture circulates material goods as a system of symbolic exchange where the power of sign value rather than the utility of things act as markers or sources and shapers of identity and social relations. Consumption became a cultural and material activity, as well as an economic and cultural practice (Mary Douglas and Baron Isherwood, *The World of Goods: Towards an Anthropology of Consumption* (London: Allen Lane, 1977); David Morley and Kevin Robbins, *Spaces of Identity: Global Media, Electronic Landscapes, and Cultural Boundaries* (London and New York: Routledge, 1995)).

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- [20] See Frederick Jameson, *Postmodernism, or the Cultural Logic of Late Capitalism* (Durham, NC: Duke University Press, 1991); David Harvey, *The Condition of Postmodernity* (Cambridge, MA: Blackwell, 1990); Celia Lury, *The Logos of the Global Economy* (London: Routledge, 2004); Marita Sturken and Lisa Cartwright, *Practices of Looking: An Introduction to Visual Culture* (Oxford: Oxford University Press, 2006).
- [21] Zambrano, "How Branding Is Unique For A Platform (Two-Sided, Network, Marketplace) Business."
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- [23] Andrei Haigu, "Strategic Decisions for Multisided Platforms," *MIT Sloan Management Review* 55 (2014): 2.
- [24] Zambrano, "How Branding Is Unique For A Platform (Two-Sided, Network, Marketplace) Business."
- [25] *ibid.*
- [26] Bern Szukalski, "GIS: Turning Geography into Geography Understanding," *Esri Insider*, February 14, 2013, accessed September 19, 2016, <https://blogs.esri.com/esri/esri-insider/2013/02/14/gis-turning-geography-into-understanding/>.
- [27] Jack Dangermond, "Geography as a Platform," *ArcNews*, 2012, accessed September 19, 2016, <http://www.esri.com/news/arcnews/fall12articles/geography-a-platform-for-understanding.html>.
- [28] Oxford University Press, *English Oxford Living Dictionary*.
- [29] Joss Hands, "Introduction: Platform, Power, and 'Platformivity,'" *Culture Machine* 14 (2013): 1.
- [30] According to Gillespie (2010), akin to that of "network" and "channel," platform carries the depth of common significations in architectural, figurative, political, and computational registers.
- [31] John Caldwell, *Production Culture: Industrial Reflexivity and Critical Practice in Film and Television* (Durham: Duke University Press, 2008).
- [32] Dangermond, "Geography as a Platform."
- [33] Caldwell, *Production Culture*, 91.
- [34] Esri, "The ArcGIS Platform in 2014: Advances on Many Fronts," *ArcNews*, Summer 2014, accessed September 19, 2016, <http://www.esri.com/esri-news/arcnews/summer14articles/the-arcgis-platform-in-2014>.
- [35] Gillespie, "The Politics of 'Platforms.'"
- [36] Olma, "Never Mind the Sharing Economy: Here's Platform Capitalism."
- [37] Esri, "ArcGIS Online Terms of Use," *ArcGIS for Developers*, 2016, accessed September 19, 2016, <https://developers.arcgis.com/terms/>.
- [38] Marc Andreessen, "Analyzing the Facebook Platform, Three Weeks In," *Pmarca.com*, June 12, 2007, https://web.archive.org/web/20071002070223/http://blog.pmarca.com/2007/06/analyzing_the_f.html.
- [39] In 2003, del.icio.us, a bookmarking web service for storing, sharing, and finding bookmarks allowed programmatic access to their sites becoming the first platform. Photo imaging site Flickr followed in 2004, YouTube in 2005, and Facebook and Twitter in 2006. After this, Web 2.0 became synonymous with "the programmatic web," and platforms became the dominant economic and infrastructural model of the social web.
- [40] Andreessen, "Analyzing the Facebook Platform, Three Weeks In."
- [41] Robert Bodle, "Regimes of Sharing," *Information, Communication, & Society* 14 (2011): 325.
- [42] See Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001); and Chun, *Programmed Visions: Software and Memory* (Cambridge, MA: MIT Press, 2001).
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- [44] *ibid.*, 8.

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- [46] *ibid*, 327.
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- [48] Jean-Christophe Plantin et al., "Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook," *New Media & Society*, pre-publication version (August 2016): 18.
- [49] *ibid*.
- [50] Sarah Elwood and Agnieszka Leszyzynski, "Privacy, Reconsidered: New Representations, Data Practices, and the Geoweb," *Geoforum* 42, no. 1 (2011): 6–15.
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- [53] OCGeo, "Open Geospatial Consortium," Last modified February 18, 2016, https://wiki.osgeo.org/wiki/Open_Geospatial_Consortium.
- [54] Reed, "OGC Standards: Enabling the Geospatial Web."
- [55] Open Geospatial Consortium, "OGC Vision, Mission, and Goals," accessed September 16, 2016. <http://www.opengeospatial.org/ogc/vision>.
- [56] Interface standards include the functional operations needed to allow an exchange of data between two different systems, while encoding standards are rules for converting geospatial content into platform ready data.
- [57] Raymund Werle, "The Impact of Information Networks on the Structure of Political Systems," in *Understanding the Impact of Global Networks on Local Social, Political, and Cultural Values*, ed. by Christopher Engel, and Kenneth H. Keller, 167-192 (Bonn, Germany: Baden-Baden (Nomos)).
- [58] According to a 2016 report by ARC Advisory Group, a leading technology research and advisory firm for industry and infrastructure founded in 1986, Esri has a 43 percent share in the GIS market, compared to 11 percent share by Quantum GIS. Esri also leads in ten industries including electric power, business, government, health, natural resources, telecommunications, retail, transportation, oil and gas refining, and water.
- [59] Eric J. Iversen, Thierry Vedel, and Raymund Wele, "Standardization and the Democratic Design of Information and Communication Technology," *Knowledge, Technology, & Policy* 17, no. 2 (2004): 110.
- [60] *ibid*, 107.
- [61] See Thomas Frank, *Conquest of Cool* (Chicago, University of Chicago Press, 1997).
- [62] Sarah Banet-Weiser, "Home is Where the Brand Is: Children's Television in a Post-Network Era," in *Beyond Prime Time: Television Programming in the Post-network Era*, ed. by Amanda Lotz (London: Routledge, 2009), 85.
- [63] Esri, "Support for OGC GeoPackage Specification in ArcGIS," April 14, 2014, <https://blogs.esri.com/esri/arcgis/2014/04/14/support-for-ogc-geopackages-in-arcgis/>.