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Could the future of public land use control lie, quite literally, in the hands of the public? Local governments have increasingly embraced new technologies like smartphone apps and online interfaces for involving constituents in land use planning and control.[1] The possibility that we could effectively "crowdsource"[2] land use decisions through novel public engagement tools is an intriguing one that is beginning to attract scholarly attention.[3] If land use conflicts represent information

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[1] *See infra* Part I (presenting and discussing examples).

[2] The term "crowdsourcing" was coined by Jeff Howe. Jeff Howe, *The Rise of Crowdsourcing*, WIRED 14.06 (June 2006), http://www.wired.com/wired/archive/14.06/crowds.html. In his book on the topic, Howe describes crowdsourcing as "an umbrella term for a highly varied group of approaches that share one obvious attribute in common: they all depend on some contribution from the crowd." JEFF HOWE, CROWDSOURCING: WHY THE POWER OF THE CROWD IS DRIVING THE FUTURE OF BUSINESS 280 (2008). I will use the term in a similarly loose manner here, while recognizing that the term may be more or less apt for different forms of user-based involvement in land use planning. *See* Jennifer Shkabatur, *Cities @ Crossroads: Digital Technology and Local Democracy in America*, 76 BROOK. L. REV. 1413, 1443-44 (2011) (defining "governmental crowdsourcing" as "the process of outsourcing certain governmental functions to the broad public, and soliciting back services, suggestions, solutions, and ideas"). The idea of crowdsourcing builds on ideas that were recently popularized in, for example, JAMES SUROWIECKI, THE WISDOM OF CROWDS (2004); a much earlier antecedent is the Condorcet Jury Theorem. *See, e.g.*, Matthew C. Stephenson, *Information Acquisition and Institutional Design*, 124 HARV. L. REV. 1422, 1462-63 (2011) (citing Marquis de Condorcet, *Essay on the Application of Mathematics to the Theory of Decision-Making* (1785), *reprinted in* CONDORCET: SELECTED WRITINGS 33 (Keith Michael Baker ed., 1976)).

[3] *See, e.g.*, Daren C. Brabham, *Crowdsourcing the Public Participation Process for Planning Projects*, 8 PLANNING THEORY 242 (2009); Shkabatur, *supra* note 2, at 1472-76; Jennifer S. Evans-Cowley, There's an App for That: Mobile Applications for Urban Planning (Oct. 29, 2011) (unpublished manuscript), *available at* http://ssrn.com/abstract=1951069; *see also* Patricia E. Salkin, *Social Networking and Land Use Planning and Regulation: Practical Benefits, Pitfalls, and Ethical Considerations*, 31 PACE L. REV. 54 (2011); Julie A. Tappendorf, *To Tweet or Not to Tweet: Use of Social Networking in Land Use Planning and Regulation*, 34 ZONING AND LAND PLANNING LAW REPORT, no. 5, May 2012, at 1. Land use planning is just one area

shortfalls,[4] finding better ways to aggregate the information dispersed among various members of the public seems like a promising strategy.[5]

Without question, technological advances can dramatically reduce the cost of informational inputs into land use coordination. But the usefulness of these inputs depends on the theoretical and institutional frameworks within which they are employed.[6] By drawing connections between emerging information technologies and the chronic information problems that produce land use conflicts, it becomes possible to reimagine the government's role in land use coordination. This essay makes a start on that project.

Two points bear emphasis at the outset. First, land use decisionmaking is already "crowdsourced" in important ways—at least if the term is read broadly to include all aggregations of widely dispersed information. Citizens provide informational inputs into land use control through market decisions,[7] political

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in which crowdsourcing and related public engagement approaches might be employed by governmental entities. *See generally* Shkabatur, *supra* note 2; William D. Eggers & Rob Hamill, *Five Ways Crowdsourcing Can Transform the Public Sphere*, GOVERNING (May 23, 2012), http://www.governing.com/columns/mgmt-insights/col-government-crowdsourcing-five-models.html (describing a variety of crowdsourcing initiatives); David Lepeska, *Coming Soon: Twitter as a Citywide Suggestions Box*, NEXT AM. CITY, (Oct. 1, 2012, 9:30 AM), http://americancity.org/daily/entry/coming-soon-twitter-as-city-suggestions-box.

[4] The Coase Theorem holds that parties will bargain to an efficient solution in the absence of transaction costs. *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 8 (1960). Information problems—whether private information about valuations that enables strategic behavior or a simple lack of knowledge about potential uses and their impacts—contribute greatly to the costs of transacting. *See* Robert C. Ellickson, *The Case for Coase and Against "Coaseanism,"* 99 YALE L.J. 611, 615-16 (1989).

[5] The idea of making use of dispersed information appears prominently in President Obama's 2009 Memorandum for the Heads of Executive Departments and Agencies on Transparency and Open Government: "Knowledge is widely dispersed in society, and public officials benefit from having access to that dispersed knowledge." Transparency and Open Government, 74 Fed. Reg. 4685, 4685 (Jan. 21, 2009), *cited and discussed in* Shkabatur, *supra* note 2, at 1443.

[6] Likewise, institutional design should be informed by the costs and incentives surrounding information acquisition and use. *See generally* Stephenson, *supra* note 2. For a critical look at the enthusiasm surrounding "many minds" models, and some helpful distinctions among them, see Adrian Vermeule, *Many-Minds Arguments in Legal Theory*, 1 J. LEGAL ANALYSIS 1 (2009).

[7] *See, e.g.*, Kenneth J. Arrow, *Information and Economic Behavior*, *in* 4 COLLECTED PAPERS OF KENNETH J. ARROW: THE ECONOMICS OF INFORMATION 136, 140 (1984) ("From the viewpoint of the society as a whole, prices are signals by which information about scarcities is transmitted among the members of society."); F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 526-28 (1945) (emphasizing the ability of the price system to aggregate dispersed information and successfully channel the use of resources).

participation,[8] Tieboutian sorting,[9] and responses to a variety of governmentally constructed choices.[10] The institution of property itself delegates agenda-setting to owners[11] and thereby widely disperses decisionmaking over the use of land. Governmental bodies have also tried for decades to spur direct public engagement in land use decisionmaking.[12] What is new, then, is not the idea of aggregating dispersed information, but rather the prospect of combining technological and theoretical advances to do so in novel and powerful ways.

Second, the law's role in the land use arena extends beyond information collection and aggregation. Government must get involved in land use decisionmaking not only because private mechanisms do not (yet) exist to reliably aggregate and deploy information, but also because society's normative commitments place constraints on the sorts of preferences and

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[8] *See, e.g.*, ALBERT O. HIRSCHMAN, EXIT, VOICE, AND LOYALTY 15-20 (1970) (contrasting political participation ("voice") with market decisions ("exit")).

[9] *See generally* Charles M. Tiebout, *A Pure Theory of Local Expenditures*, 64 J. POL. ECON. 416 (1956). Tiebout analogized the choice among local governments to a shopping trip; residents sort themselves into jurisdictions by selecting the bundles of taxes and services that best match their preferences. *See id*. at 422.

[10] For example, taxes, subsidies, liability rules, and tradable permits all present agents with choices that both influence behavior and harness information. *See, e.g.*, Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 725 (1996) (discussing the information-harnessing properties of liability rules).

[11] *See, e.g.*, Larissa Katz, *Exclusion and Exclusivity in Property Law*, 58 U. TORONTO L.J. 275, 289-93 (2008) (presenting the idea of owners as "agenda setters"); Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719, 1728, 1754-55 (2004) (discussing property as delegation).

[12] *See, e.g.*, James Q. Wilson, *Planning and Politics: Citizen Participation in Urban Renewal*, 29 J. AM. INST. OF PLANNERS 242 (1963). A variety of creative participatory techniques have been used, many of which do not depend on advanced technology. *See, e.g.*, STEFANO DI GESSA ET AL., INT'L LAND COAL., PARTICIPATORY MAPPING AS A TOOL FOR EMPOWERMENT 21 (2009), *available at* http://www.landcoalition.org/publications/participatory-mapping-tool-empowerment (describing a project that involved the public in creating physical three-dimensional maps in the Philippines); Andrew Leonard, *House's Collaboration Cart Puts Community Planning on the Street*, GRIST (Nov. 20, 2011), http://grist.org/cities/2011-11-20-houses-collaboration-cart-puts-community-planning-on-the-street (describing a physical cart containing tools for collecting public reactions, and a park renovation project in New York's Chinatown in which residents were encouraged to write or draw their ideas and wishes on paper lanterns); *Oversized Cake Gets NDG Residents Talking*, CBC NEWS (Nov. 18, 2011), http://www.cbc.ca/news/canada/montreal/story/2011/11/18/mtl-cake.html (chocolate cake replica of a neighborhood placed alongside a table "where passing people could write their hopes for the neighbourhood"); *see also* James Brasuell, *Draft Burbank General Plan is Both Adorable and Progressive*, CURBED LA (Mar. 30, 2012), http://la.curbed.com/archives/2012/03/proposed_burbank_general_plan_is_both_adorable_and_progressive.php (discussing Burbank's use of an avatar known as "Planner Andy" to "help crowdsource ideas about how residents view their city," and Burbank's suggestion that Andy be printed out and photographed around the city).

projects that may be pursued. No amount of crowdsourcing can remove governmental responsibility over certain normative objectives, such as countering discrimination. This observation places limits on the use of new information aggregation tools, but it does not mean that these tools present unusual or unique risks. On the contrary, a conscious focus on crowdsourcing may usefully pull apart normative and empirical questions that have been conflated in existing land use decision processes and place new emphasis on the government's normative obligations.

The essay proceeds in two steps. Part I connects past theoretical work to three types of information that technology can make more affordable: land use impacts as they exist on the ground, landowners' future plans, and preferences for patterns of land use. Part II examines how government's role in coordinating land uses might shift away from top-down regulation and toward the design of platforms for collecting and using information.[13] This analysis suggests a revised understanding of local governments as information collectors, aggregators, brokers, and managers who are also charged with pursuing certain normative goals.

I. INFORMATION SHORTFALLS AND NEW TECHNOLOGIES

Land use inefficiencies largely boil down to information failures.[14] Information about land use intentions, impacts, and valuations is fragmented among a multitude of owners and other constituents who are distributed across time and space. If bargaining were costless, this dispersed information would be automatically aggregated in the process of making land use deals.[15] The result would be an efficient set of spatial and temporal adjacencies and use patterns. Perfect insurance markets would allow actors to hedge their bets in ways that would make them risk neutral, eradicating NIMBYism—at

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[13] *See* Shkabatur, *supra* note 2, at 1460-63 (citing Tim O'Reilly, *Government as a Platform*, *in* OPEN GOVERNMENT: COLLABORATION, TRANSPARENCY, AND PARTICIPATION IN PRACTICE 11, 13 (Daniel Lathrop & Laurel Ruma eds., 2010)) (discussing and critiquing the view of government as "platform provider" that has emerged in the context of digital initiatives); *see also infra* Part II.

[14] This follows from the large role that information costs play in raising the costs of transactions and in generating strategic behavior. *See, e.g.*, Ellickson, *supra* note 4, at 615-16.

[15] *See generally* Coase, *supra* note 4. A primary impediment to the efficient resolution of land use conflicts is strategic behavior that stems from private information about reservation prices. *See, e.g.*, Kenneth J. Arrow, *The Property Rights Doctrine and Demand Revelation Under Incomplete Information*, *in* 4 ARROW, *supra* note 7, at 216-18; Ellickson, *supra* note 4, at 616 n.25.

least to the extent that actors are free of irrational prejudices.[16] In a world of zero transaction costs, property rights in all land uses and their impacts could be established and perfectly priced; all potential land use conflicts could be instantly sorted out to an efficient resolution.[17]

In the real world, landowners need institutional help in coordinating their uses. Spatial adjacencies have traditionally been managed through some mix of nuisance law, zoning, and covenants. These tools implicitly or explicitly proceed from empirical judgments about impacts, preferences, and future plans. For example, residential uses are separated from commercial uses on the assumption that impacts emanating from the latter will negatively affect the former. As debates over mixed-use districts suggest, however, these judgments are open to question.[18]

Temporal adjacencies raise analogous but distinct issues, and managing them also requires empirical judgments and predictions. Trusts and the doctrine of waste offer different models for reconciling the interests of successive possessors.[19] The fee simple estate, which extends forward indefinitely in time, might be expected to obviate concerns about temporal spillovers: any negative effects on the land should show up in resale values.[20] Information problems remain, however.

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[16] NIMBY is a well-known acronym for "not in my backyard." To say that full information would make NIMBYism unproblematic is not to say that everyone would want everything in their own backyards all the time. Rather, decisions would be based on the expected value of impacts, and positive-value projects would get optimally placed rather than excluded altogether. In other words, YIMBYs ("yes in my backyard" types) would balance out NIMBYs—at least to the extent that a given project is a worthwhile one and actors are rational. The possibility that irrational prejudices could persist even in a world of costless bargaining connects to the problem of illegitimate preferences.

[17] For example, one landowner might own the right to play music at a certain level or another landowner might hold an entitlement not to be subjected to decibels above a certain level, with exceptions and refinements costlessly negotiated. An efficient resolution might or might not be a normatively attractive one. Not only could there be unwanted distributive effects in some efficient resolutions, there are some preferences (such as racial prejudices) that for normative reasons should not be vindicated, regardless of willingness to pay. Addressing these concerns requires a continuing governmental role in land use control, beyond merely overcoming information shortfalls. *See infra* Part II.

[18] *See, e.g.*, NICOLE STELLE GARNETT, ORDERING THE CITY: LAND USE, POLICING, AND THE RESTORATION OF URBAN AMERICA 64-76 (2010) (discussing Jane Jacobs's view that increased informal surveillance in mixed-use areas would lead to lower crime rates and empirical work suggesting otherwise, as well as the possibility that there are improvements in quality of life not captured in the crime statistics).

[19] *See, e.g.*, JESSE DUKEMINIER ET AL., PROPERTY 216-18 (7th ed. 2010).

[20] *See, e.g.*, Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV., no. 2, 1967, at 347, 355 (describing a private landowner as "a broker whose

Efficient shifts in land use over time often require changes in the physical scope or scale of ownership—it may be necessary to assemble land into larger tracts or disassemble it into smaller parcels. Achieving these reconfigurations can present difficult bargaining dynamics, given the existence of private information about reservation prices. These problems cannot be forestalled ex ante without accurately predicting future efficient scales;[21] they cannot be addressed coercively ex post (as through eminent domain) without confronting serious valuation problems.[22]

For all these reasons, better information can improve the management of land use adjacencies. But there are two problems. First, information is notoriously costly and should not be acquired beyond the point where it produces net marginal gains.[23] Second, some types of information can impede rather than ease bargaining; knowing more about a situation may enable parties to behave strategically, or it may offer them ammunition for interpreting facts in ways favorable to their own interests.[24] The emergence of new technologies that lower the cost of acquiring information would be expected to shift the efficient level of information acquisition upward, but information acquisition must be coupled with theoretical advances that make information useful and that sidestep self-interested behavior. Technological and theoretical advances must be considered in tandem, then, to usefully transform land use decision processes.

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wealth depends on how well he takes into account the competing claims of the present and the future").

[21] *See* Larissa Katz, *Red Tape and Gridlock*, 23 CAN. J.L. & JURISPRUDENCE 99, 120-21 (2010) (challenging the idea that we can identify a resource's "ideal use" in advance and arrange property rights to achieve it).

[22] As has been well noted, owners may assign a subjective value to their property that is well in excess of its market value. *See, e.g.*, Thomas W. Merrill, *The Economics of Public Use*, 72 CORNELL L. REV. 61, 83 (1986). There have been many efforts to design mechanisms that would uncover or approximate owners' subjective values, but the problem remains a very difficult one.

[23] George J. Stigler, *The Economics of Information*, 69 J. POL. ECON. 213, 224 (1961) ("Ignorance is like subzero weather: by a sufficient expenditure its effects upon people can be kept within tolerable or even comfortable bounds, but it would be wholly uneconomic entirely to eliminate all its effects.").

[24] *See, e.g.*, Gary D. Libecap, *Contracting for Property Rights*, *in* PROPERTY RIGHTS: COOPERATION, CONFLICT, AND LAW 142, 161-62 (Terry L. Anderson & Fred S. McChesney eds., 2003) (explaining how bargaining in the context of oil unitization can be more successful at an earlier stage when less information is known and parties do not know whether a given formula will work to their advantage or disadvantage); Linda Babcock & George Loewenstein, *Explaining Bargaining Impasse: The Role of Self-Serving Biases*, 11 J. ECON. PERSP. 109 (1997) (discussing the impact of self-serving bias on bargaining dynamics).

The sections below show how addressing three types of information shortfalls might produce gains that have been outlined in existing theoretical work. First, information about impacts could support a shift from a land use control system that focuses on use classifications or inputs to one that focuses on impacts or outcomes. Second, information about intentions could build more "precaution" into land use choices, as through the increased use of options to coordinate land use ex ante.[25] Third, information about desired use patterns can support innovations that harness interdependent decisionmaking and address associational spillovers.

A. Land Use Impacts

Zoning decisions proceed on assumptions about the impacts of various land uses on other land uses. Presumed land-on-land spillovers form a primary rationale for separating uses or for privileging particularly sensitive uses, such as single-family residences. Likewise, housing code enforcement and police priorities are often driven by assumptions about the effects of certain kinds of violations and conditions on quality of life.[26] Land use regulation usually proceeds by ruling out categories of uses or requiring particular property configurations, such as minimum setbacks. Yet the actual impacts of particular uses and configurations are often unknown—at least to local government officials and in-movers. Not only could such information improve traditional use-based zoning, it could also support performance zoning that is directly based on land use impacts.[27]

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[25] *See generally* Lee Anne Fennell, *Property and Precaution*, 4 J. TORT L., no. 2, at 1 (2011).

[26] The "broken windows" hypothesis, which has been challenged empirically, embodies some of these assumptions. *See, e.g.*, GARNETT, *supra* note 18, at 21-26.

[27] Although the term "performance zoning" covers a range of approaches, the basic idea involves relying less on use categories and more on actual impacts. *See, e.g.*, JANE JACOBS, DARK AGE AHEAD 153-57 (2004) (discussing advantages of a "performance code" that addresses concerns about noises, odors, traffic, and other impacts); DOUGLAS R. PORTER ET AL., FLEXIBLE ZONING: HOW IT WORKS 11 (1988) ("Theoretically, in a regulatory system based solely on performance standards, any use could locate adjacent to any other use, provided that it could satisfy the criteria and standards contained in the ordinance."); Frederick W. Acker, Note, *Performance Zoning*, 67 NOTRE DAME L. REV. 363 (1991) (explaining the rationale for performance zoning and comparing proposals). One challenge in implementing performance standards is the difficulty of monitoring for violations. Martin Jaffe, *Performance Zoning: A Reassessment*, 45 LAND USE L. & ZONING DIG., Mar. 1993, at 3, 4 (discussing this problem in the context of industrial performance controls).

Zoners and planners are not entirely in the dark about impacts. Hedonic regression analysis can measure the effects of particular uses—from wind turbines to community gardens—on neighboring property values.[28] Grounding land use decisions in these data represents a considerable advance over proceeding by intuition. But the results can be complicated by the fact that property values are based on expectations about impacts, rather than the impacts themselves. Moreover, the expectations in question are not only those held by buyers, but also those that buyers imagine third parties hold.[29] Once the risk aversion that typically accompanies residential ownership is added to the mix,[30] the discount associated with a particular land use may diverge considerably from that use's actual effects on consumption utility.

The current level of governmental ignorance about impacts is not inevitable. It could be overcome by harnessing information that already exists, dispersed in the hands of the public. People residing within, commuting through, or just visiting a jurisdiction collectively possess a lot of information about land uses and conditions within the jurisdiction, including details about the intensity and prevalence of certain uses, and their effects on quality of life. Some questions, such as the noise levels produced by certain kinds of machinery and the degree to which the noise interferes with different sorts of activities, are matters on which knowledgeable individuals across the country or around the world may have insight.

Finding ways to obtain the scattered information these sources possess is a challenge, but one that might be approached with some optimism. Consumers volunteer enormous amounts of information about their experiences with

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[28] *See, e.g.*, DENISE DIPASQUALE & WILLIAM C. WHEATON, URBAN ECONOMICS AND REAL ESTATE MARKETS 189-90 (1996) (describing the hedonic approach to valuing housing attributes and describing some difficulties associated with using it); Vicki Been & Ioan Voicu, *The Effect of Community Gardens on Neighboring Property Values*, 36 REAL ESTATE ECON. 241 (2008); Yasin Sunak & Reinhard Madlener, *The Impact of Wind Farms on Property Values: A Geographically Weighted Hedonic Pricing Model* (Future Energy Consumer Needs & Behavior, Working Paper No. 03/2012, 2012), *available at* http://ssrn.com/abstract=2114216 (applying a hedonic pricing model to determine the effects of wind farms on property values in western Germany).

[29] The problem is familiar to anyone who has studied stock market bubbles. John Maynard Keynes famously described the stock market as a beauty contest in which participants are asked not who they find most beautiful but who they expect everyone else to find most beautiful. *See* David Kestenbaum, *Ranking Cute Animals: A Stock Market Experiment*, NPR PLANET MONEY (Jan. 14, 2011), http://www.npr.org/blogs/money/2011/01/04/132906135/ranking-cute-animals-a-stock-market-experiment (describing an experiment based on Keynes's insight).

[30] *See* WILLIAM A. FISCHEL, THE HOMEVOTER HYPOTHESIS 9-12 (2001).

products and services, including location-specific reactions to hotels, apartments, parks, and even neighborhoods.[31] This information is not presently elicited or aggregated in a way that is likely to be very useful for land use control purposes.[32] But it could be.

What is necessary are a set of conditions that both enable and motivate people who possess the relevant information to reveal it. Providing the *ability* to contribute information, which requires developing and distributing appropriate technologies, is likely the easier part of the equation to solve. Some localities, nonprofits, and entrepreneurs have already begun experimenting with smartphone apps that allow people to report observed problems like potholes or malfunctioning streetlamps on the fly. Perhaps the best known of these is the SeeClickFix smartphone app used by a number of local governments, modeled on the earlier FixMyStreet app developed in the United Kingdom.[33] Other apps, such as Widenoise, are designed to monitor localized conditions—in this case, ambient noise levels.[34] Similar in spirit are kite photography programs for recording local conditions[35] and "Bucket Brigade" initiatives that allow citizens to collect and report real-time, localized air quality results.[36]

While these approaches represent only early examples of how land use data collection might proceed, they

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[31] *See, e.g.*, APARTMENTRATINGS, http://www.apartmentratings.com (last visited Sept. 5, 2012); TRIPADVISOR, http://www.tripadvisor.com (last visited Sept. 5, 2012); YELP, http://www.yelp.com (last visited Sept. 5, 2012).

[32] Indeed, confusion about the subject of discussion appears to reign in some online fora. For example, one review in Yelp's listing for Chicago's Lincoln Park began, "Is this a review of an entire neighborhood or just for the parks?" Jim O's Review, *Lincoln Park*, YELP (June 11, 2009), http://www.yelp.com/biz/lincoln-park-chicago#hrid:-oewnWvOIz4wNgfQ31gIBA.

[33] FIXMYSTREET, http://www.fixmystreet.com (last visited Sept. 5, 2012); SEECLICKFIX, http://www.seeclickfix.com (last visited Sept. 5, 2012); *see also* Shkabatur, *supra* note 2, at 1447-48 (discussing these and similar apps). Another variation on this theme is BlightStatus, an app that allows citizens in New Orleans to report, and track governmental responses to, blighted conditions. *See* Emily Badger, *Revitalizing New Orleans by Crowdsourcing Renewal*, CO.EXIST (Oct. 19, 2012), http://www.fastcoexist.com/1680759/revitalizing-new-orleans-by-crowdsourcing-renewal.

[34] *See* WideNoise, *Ever Heard of Sound Pollution?*, EVERYAWARE, http://cs.everyaware.eu/event/widenoise (last visited Feb. 21, 2013); *see also* Evans-Cowley, *supra* note 3, at 5 (discussing Widenoise and the potential that such a "[p]articipatory sensing" application could improve land use planning).

[35] *See, e.g.*, Martijn de Waal, *How Kite Photography Can Empower Local Communities*, MOBILE CITY (Oct. 19, 2011), http://www.themobilecity.nl/2011/10/19/how-kite-photography-can-empower-local-communities/.

[36] LOUISIANA BUCKET BRIGADE, http://www.labucketbrigade.org (last visited Sept. 19, 2012).

demonstrate the potential of new technologies to collect, in real time, broadly dispersed information related to land use. A set of impact indexes might be developed to which the public could be invited to contribute both qualitative and quantitative information. Contributions might be actively solicited from those who live near a given use or commute past it.[37] Of course, the challenge of achieving optimal levels of participation remains—a point that will be discussed further below.[38]

We might also worry about the accuracy and representativeness of the information submitted. This concern is heightened when some of the people in the best position to know about a given impact also have a vested interest in the magnitude of that impact. These interests might cut in different directions. For example, a homeowner poised to sell might want to understate the impact of the cheese factory next door, while a long-time resident who is lobbying to get the factory shut down might want to overstate its impact. Concerns about biased feedback are nothing new, but there are some mechanisms for dealing with them, including reputational ratings.[39] Moreover, in some impact contexts, information gathered from one community (say, about the noise level associated with a particular kind of turbine) can be used elsewhere, reducing the chance of gaming.

Nonetheless, rollouts of new impact-detecting apps must be carefully managed to reduce the risk of systematic biases. For example, we might not expect people who are early adopters of a noise-detecting app to be representative along the dimension of noise tolerance, nor would we expect them to be evenhanded in choosing when to measure impacts. As a first cut, a governmental body could wait until it has collected commitments from a cross-section of the population to participate in an impact-gathering program before launching it. Alternatively, local governments might consider relatively localized pilot projects involving proprietary governmental

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[37] Local governments have developed mapping programs based on Geographic Information Systems (GIS) technology to study commuting patterns. Such applications may make it possible to identify people who are likely to commute along a given pathway. *See, e.g.*, Eric Coumou, *ESRI Map Book Gallery Vol. 22: Carson Valley Employment and Housing*, http://www.esri.com/mapmuseum/mapbook_gallery/volume22/state_local4.html; *see also* Evans-Cowley, *supra* note 3, at 5 (suggesting that people could volunteer to have their routes tracked and aggregated for transportation planning purposes).

[38] *See infra* Part II.A.

[39] *See, e.g.*, LIOR JACOB STRAHILEVITZ, INFORMATION AND EXCLUSION 127-29 (2011).

apps (perhaps themselves the product of crowdsourcing initiatives) provided free of charge, along with the loaned hardware necessary to run them.[40]

Local governments could also phase in the use of crowdsourced impact information, allowing it to play a larger role in land use policy as publicity builds and participation grows. For example, noise level information might first be used to augment other information sources in refining traditional zoning classifications,[41] and only later be used to inform the development of performance standards. Moreover, performance zoning approaches that focus on land use impacts need not be adopted as a stand-alone replacement for existing public land use controls. They can instead be layered onto Euclidian zoning as an additional constraint,[42] made part of a process through which a landowner can be selectively released from existing land use restrictions,[43] or combined with other land use control techniques, such as tradable permits.[44]

Although these approaches lend themselves most obviously to the control of spillovers, impact information could also be used in other ways to improve the quality of the built environment. If different environments affect people's subjective well-being in systematic ways, then the aggregation of information about these hedonic impacts could usefully inform both private and governmental land use choices. If the government learns, for example, that curved residential streets make people happier than grids (or vice versa), it can use that

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[40] Approaches based on the Experience Sampling Method (ESM) used in hedonics, which prompts people at random times throughout the day to report results, could be used to counter selectivity in the timing of impact measurement. *See* JOEL M. HEKTNER ET AL., EXPERIENCE SAMPLING METHOD: MEASURING THE QUALITY OF EVERYDAY LIFE 6-7 (2007) (describing the ESM and noting some limitations and drawbacks, including the fact that it can be expensive to implement).

[41] *Cf.* Bradford C. Mank, *Preventing Bhopal: "Dead Zones" and Toxic Death Risk Index Taxes*, 53 OHIO ST. L.J. 761, 779-84 (1992) (discussing how performance standards might be used in conjunction with Geographic Information Systems (GIS) programs to calculate optimal buffer zones around hazardous waste sites).

[42] *See* Robert J. Blackwell, Comment, *Overlay Zoning, Performance Standards, and Environmental Protection After* Nollan, 16 B.C. ENVTL. AFF. L. REV. 615, 637-39 (1989); *see also generally* LANE KENDIG ET AL., PERFORMANCE ZONING (1980) (presenting a performance zoning proposal that combines use districts with performance standards).

[43] *See* Anita P. Miller, *Rural Development Considerations for Growth Management*, 43 NAT. RESOURCES J. 781, 789-91 (2003) (describing such an approach in Rio Arriba County, New Mexico).

[44] *See* John R. Ottensmann, *Market-Based Exchanges of Rights Within a System of Performance Zoning*, 1(1) PLAN. & MARKETS (1998), *available at* http://www-pam.usc.edu/volume1/v1i1a4s1.html.

information as an input into street design or make the data available to private developers or consumers.[45]

B. Land Use Intentions

A second area of land use ignorance involves intentions. Neighbors, prospective in-movers, and governmental bodies often lack insight into what landowners intend to do with their properties in the future.[46] It is useful to pinpoint the source of this uncertainty. A system of land use control that is both flexible enough to adapt to changes in conditions and broadly framed enough to accommodate heterogeneity among owners will usually build some unused capacity into most landowners' entitlements. Thus, most landowners have some ability to engage in uses that are a bit more intense or that fill a somewhat larger proportion of the three-dimensional envelope that defines their spatial claim. They might, for example, be able to build a second-story addition, grow a row of Sequoia trees, start a small in-home day care center, or kennel a pack of hunting dogs in the backyard. These dormant options can make it difficult for neighbors and potential in-movers (or out-movers) to predict future uses. And they can make it difficult for zoners and planners to coordinate land uses over time.

Ignorance about intentions heightens the potential for costly land use conflicts. A few primary strategies presently exist for reducing the resulting uncertainty, each of which has drawbacks of its own. First, local governments already incentivize the disclosure of future plans when they grant vested rights or other dispensations as projects move toward actualization.[47] Requiring affirmative steps toward realizing

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[45] We might wonder why consumers are not already demanding design choices that make them happier. The answer, explored in more detail in Part I.C, may be that revealed preferences in the marketplace (or in the Tieboutian analog of a marketplace) can only respond to available options. Existing options in turn may be shaped by a variety of factors, including path dependence. *See, e.g.*, Robert C. Ellickson, *The Law and Economics of Street Layouts: How a Grid Pattern Benefits a Downtown*, 64 ALA. L. REV. (forthcoming 2013), *available at* http://ssrn.com/abstract=2152442 (discussing path dependence and other considerations relevant to street layout choices, including potential tradeoffs between aesthetics and the advantages of a grid system).

[46] To be sure, the owners themselves may often lack this insight as well. But owners as a group collectively possess more information about land use intentions than do those who are charged with making land use policy.

[47] *See generally* Christopher Serkin, *Existing Uses and the Limits of Land Use Regulations*, 84 N.Y.U. L. REV. 1222 (2009) (describing and critiquing protections for existing uses and vested rights).

one's intentions before those intentions will be protected does help to screen for sincerity.[48] But this requirement also creates unwanted pressures towards rushed development.[49] Protecting uses only as they become reality is an information-forcing device, but it is also a development-forcing device.

Narrowing the band of possible uses through zoning or other land use controls is another way that local governments can render land use more predictable. As suggested already, uncertainty about land use intentions is a function of the gap between present uses and permitted uses. If that gap is completely regulated away, the actual use becomes the maximum use, and uncertainty is removed. Somewhat less extreme versions of this strategy can be seen in very finely grained zoning classifications that, for example, divide two-family homes from three-family homes, and small apartment buildings from somewhat larger ones. This approach tends toward regulatory overkill; narrowing the permissible uses in a given area may rule out uses that would have been efficient to introduce. Zoning restrictions can be loosened to address this concern,[50] but making zoning more flexible undermines any certainty that might follow from having the narrow zoning restrictions in the first place.[51]

Another approach to uncertainty about intentions involves direct dealmaking among landowners to remove the potential for unexpected or unwanted land use changes. Such dealmaking often occurs on a large, developer-mediated scale in private residential communities. The webs of covenants that residents buy into take the narrow zoning classification strategy described above to a new level. Not only may permissible uses be defined at a much finer grain than in the typical zoned neighborhood, the covenants may be more difficult to alter.[52] Yet again, the rigidity comes at a price,

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[48] *See generally* Daphna Lewinsohn-Zamir, *Identifying Intense Preferences*, 94 CORNELL L. REV. 1391 (2009) (discussing various mechanisms that the law uses to identify sincere or intensely held preferences).

[49] *See, e.g.*, Serkin, *supra* note 47, at 1283.

[50] Landowners can, for example, seek variances or attempt to have an area rezoned; the applicable legal standards will determine how easy or difficult these moves will be.

[51] Performance zoning, discussed in Part I.A., *supra*, could help to blunt the effects of uncertainty about uses by controlling cross-border impacts. But it would not be able to deal well with heterogeneity in sensitivity to impacts, and so might overregulate or underregulate in a given situation.

[52] Common interest communities may require a supermajority to change a covenant, whereas the ordinary political processes governing zoning are majoritarian.

especially if it imposes uniformity on a larger scale than is efficient. For example, banning tall trees from an entire neighborhood may do a good job of protecting the expectations of those who want sweeping views or solar panels, but it might also create a less interesting and pleasing community than would a judicious mix of open vistas and tall trees. To achieve more fine-grained results, individual landowners could bargain with each other directly to place limits on future land uses. Such bargaining may run aground, however, due to high search costs[53] or bilateral monopoly dynamics.[54]

What is needed—and what new information technologies can support—is a platform that enables landowners to find each other and credibly signal their intentions before any dispute arises between them, without anyone having to break ground on a given project. Although space does not permit a full description here, the basic idea is for a governmental body to host a kind of clearinghouse in which parties can buy and sell options on land use rights.[55] For example, an owner who has no intention of blocking a beautiful view enjoyed by a neighboring property might happily transfer an option on the view rights to a centralized exchange, in return for a modest payment. Later, a neighbor who wanted to secure those view rights would be able to purchase them at a preset price. Platforms that enable such deals among private parties can also provide useful guidance to local governments about demand levels for different sorts of land use arrangements.

Information about plans and intentions might do more than merely forestall conflict; it might also offer new ways to collaboratively enhance the value that parties derive from their land.[56] Already, new technologies have opened up alternatives that were previously elusive, such as the possibility that

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[53] *See, e.g.*, Stewart E. Sterk, *Property Rules, Liability Rules, and Uncertainty About Property Rights*, 106 MICH. L. REV. 1285, 1296 (2008).

[54] *See, e.g.*, Stewart E. Sterk, *Neighbors in American Land Law*, 87 COLUM. L. REV. 55, 58-59 (1987).

[55] The approach described in the text is explored in Fennell, *supra* note 25. It is sometimes suggested that property rights allow owners themselves to serve as a kind of clearinghouse for the land use rights contained within their default entitlement bundles. Sterk, *supra* note 53, at 1295 (citing Smith, *supra* note 11, at 1728-29). High search costs and bilateral monopoly dynamics may make the government a better clearinghouse provider, as long as it can induce owners to provide the necessary information about what is on offer within the clearinghouse.

[56] Of particular interest are initiatives that would facilitate the sharing of excess capacity. *See generally* Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273 (2004) (explaining the role of excess capacity in social production).

strangers could share gardens and backyards,[57] form carpools,[58] and so on. Formatting and delivering information about these resources to neighbors and potential in-movers could improve locational decisions by revealing features of the environment that would otherwise remain undiscovered. Homebuyers can see public parks on a map, but they cannot see the neighbors who would be interested in sharing gardening space. Interfaces that pool such information could also help to uncover shared interests and foster the kind of "multiplex" interactions that can help to support social norms among those already in the community.[59] Nextdoor.com offers a social networking space available only to verified neighbors that might be used to accomplish similar goals.[60]

Knowing what current landowners plan to do with their properties is only one part of the puzzle. Optimizing land use policy also requires knowing something about how demand for different land uses will evolve in the future as rounds of entry and exit occur. Information about economic, employment, and infrastructure factors that are likely to influence migration and demand patterns is helpful in this regard, and new GIS-based forecasting tools can help to uncover it.[61] In addition, it is necessary to gain insight into people's preferences for patterns of uses—preferences that are shaped in turn by existing use patterns. The next section explains.

C. Land Use Pattern Preferences

Economists rely on the notion of "revealed preferences"—the idea that we can infer preferences by watching what people do in the marketplace when their own money is on the line. For two reasons, however, observing market demand for particular land uses may be misleading. First, land *uses* (as opposed to

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[57] *See, e.g.*, LANDSHARE, http://www.landshare.net (last visited Sept. 10, 2012) (online service matching would-be gardeners without land with people who have extra land available for gardening).

[58] *See, e.g.*, Mickey Meece, *Car-Pooling Makes a Surge on Apps and Social Media*, N.Y. TIMES, July 5, 2012, at B1 (describing the role of sites like Zimride.com and eRideShare.com in popularizing car-pooling and ride-sharing).

[59] *See* ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 179 n.44 (1991).

[60] *See* Randall Stross, *Meet Your Neighbors, If Only Online*, N.Y. TIMES (May 12, 2012), http://www.nytimes.com/2012/05/13/business/on-nextdoorcom-social-networks-for-neighbors.html.

[61] *See, e.g.*, Deborah Dennison, *ERSI Map Book Gallery Vol. 23: Analyzing U.S. Household Migration Patterns*, http://www.esri.com/mapmuseum/mapbook_gallery/volume23/statelocal3.html (last visited Oct. 8, 2012).

land itself) are not the subject of free-market transactions. Nuisance law, zoning, and other land use controls tightly constrain what uses may be undertaken on particular parcels. While there is some ability to negotiate around existing restrictions, the process is not one that approximates an open market. Second, the only preferences that can be revealed in the marketplace are for things that the marketplace offers. Where particular patterns of land use do not yet exist, it is difficult to gauge demand for them.[62]

To approach the point from a different angle, preferences for land use almost always depend on the uses that are proximate in time and space, given the degree to which the values associated with particular concurrent or successive uses are interdependent. Local governments do not know which spatial and temporal land use patterns incumbents and potential in-movers prefer, because governments can only observe binary (entry and exit) responses to existing patterns. Such a choice provides no information about preferences for alternatives that are not available, and may even contribute to their continued unavailability.[63]

Models pioneered by Thomas Schelling establish that when locational decisionmaking is highly interdependent, patterns can become entrenched or, alternatively, can be sensitive to unraveling as moves beget other moves.[64] Although Schelling's work is most closely associated with patterns of racial segregation and integration, similar points might be made about movements prompted by other forms of heterogeneity or homogeneity, or by patterns of aesthetic elements or land use impacts. Agent-based models can

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[62] Not only is it impossible for unavailable alternatives to be selected, it may even be impossible for people to envision them fully enough to form preferences for them. This is part of a broader set of problems that plague future goods in general, where market uncertainty runs high. *See, e.g.*, Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337 (2008) (arguing that market uncertainties suppress innovation in the absence of intellectual property protections for market experimentation); Kenneth J. Arrow, *Limited Knowledge and Economic Analysis*, 65 AM. ECON. REV. 1, 9 (1974) (explaining how "the absence of some markets for future goods may cause others to fail" due to uncertainty, and discussing general problems of uncertainty due to "technological and taste shifts").

[63] *See* JOHN H. MILLER & SCOTT E. PAGE, COMPLEX ADAPTIVE SYSTEMS: AN INTRODUCTION TO COMPUTATIONAL MODELS OF SOCIAL LIFE 17-20 (2007) (presenting an example in which two cities fail to offer an alternative that a substantial minority would prefer, yet the situation is at an equilibrium); THOMAS C. SCHELLING, MICROMOTIVES AND MACROBEHAVIOR 146 (1978) ("People who have to choose between polarized extremes—a white neighborhood or a black . . . —will often choose in the way that reinforces the polarization.").

[64] *See* SCHELLING, *supra* note 63, at 147-66.

simulate patterns of change over time based on particular conditions and strategies.[65] Crowdsourcing could be combined with these dynamic models in at least three ways.

First, and most simply, new information technologies could inform the assumptions plugged into agent-based models. For example, designing a Schelling-type simulation requires knowing something about preferences for neighbors, and when moves will be initiated. There are some existing mechanisms for gathering this information,[66] but new technologies offer flexible opportunities to expand the pool of data and obtain more fine-grained information about the geographic distribution of preferences within a metropolitan area.

Second, "the crowd" could become involved in multiplayer simulations online that are designed to test the effects of particular changes in land use patterns.[67] While most agent-based models employ simulated agents that follow particular rules in the manner indicated above, the rise of massively multiplayer online games (MMOGs) suggests another possibility—involving actual people in online interactive simulations. A research group organized under the name The Responsive City has initiated some interesting work along these lines,[68] including an online design game;[69] a broader research initiative, World of Citycraft, appears to now be

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[65] *See, e.g.*, MICHAEL BATTY, CITIES AND COMPLEXITY: UNDERSTANDING CITIES WITH CELLULAR AUTOMATA, AGENT-BASED MODELS, AND FRACTALS 209-16 (2005); Randal C. Picker, *SimLaw 2011*, 2002 U. ILL. L. REV. 1019, 1023-29.

[66] *See, e.g.*, Camille Zubrinsky Charles, *Processes of Racial Residential Segregation*, *in* URBAN INEQUALITY: EVIDENCE FROM FOUR CITIES 217, 233-64 (Alice O'Connor et al. eds., 2001) (describing "show card" methodology for eliciting preferences about neighborhood racial composition and presenting results of a multi-city study); Maria Krysan et al., *Does Race Matter in Neighborhood Preferences? Results from a Video Experiment*, 115 AM. J. SOC. 527 (2009) (presenting the results of a study examining differences in ratings of neighborhoods based on video vignettes, where all neighborhood features were held constant except the races of the people appearing in the vignette).

[67] Urban simulations have a long history, reaching back into the 1950s. *See* Igor Mayer et al., *Beyond SimCity: Urban Gaming and Multi-Actor Systems*, *in* MODEL TOWN: USING URBAN SIMULATION IN NEW TOWN PLANNING 168, 169-71 (2009) (providing a succinct history). For some relatively early treatments, see generally Richard L. Meier, *"Game" Procedure in the Simulation of Cities*, *in* THE URBAN CONDITION: PEOPLE AND POLICY IN THE METROPOLIS 348 (Leonard J. Duhl ed., 1963); JOHN L. TAYLOR, INSTRUCTIONAL PLANNING SYSTEMS: A GAMING-SIMULATION APPROACH TO URBAN PROBLEMS (1971).

[68] *See TReC—The Responsive City*, www.theresponsivecity.org (last visited Sept. 19, 2012).

[69] *See* Ekim Tan & Juval Portugali, *The Responsive City Design Game*, *in* COMPLEXITY THEORIES OF CITIES HAVE COME OF AGE 369 (Juval Portugali et al. eds., 2012).

underway.[70] Similarly, Mojang and UN Habitat used the popular Minecraft platform as a foundation for their new Block by Block project, which allows residents to collaborate in virtual space over potential changes to the surrounding area.[71]

Third, and most ambitiously, online interfaces could be used to get potential owners and land users to conditionally commit to particular courses of action, contingent on others agreeing to do the same. Antecedents of this approach include "money-back" guarantees for contributions to public goods[72] and, more generally, the idea of contingent markets.[73] The ability to execute binding property instruments—covenants and easements capable of running with the land—would be necessary elements of this approach. As such, a workable conditional commitment interface would require considerable institutional support. Yet it also represents one of the most exciting possibilities for making use of distributed information about preferences to construct alternatives that do not presently exist.

II. LAND USE CONTROL AS PLATFORM DESIGN

At least one commentator has suggested that new technologies could profoundly alter, if not eliminate altogether, the role of land use planners.[74] The examples above might seem

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[70] *See World of Citycraft Wins "Kom Je Ook?" 6*, TREC, http://www.theresponsivecity.org/2010/11/02/woc-world-of-citycraft/ (last visited Sept. 19, 2012). The name echoes that of the popular MMOG, World of Warcraft.

[71] Carl Manneh, *Mojang and UN Presents: Block by Block*, MOJANG (Sept. 5, 2012), http://www.mojang.com/2012/09/mojang-and-un-presents-block-by-block/. The Block by Block project originated in the Mina Kvarter ("My Blocks") project launched by Svensk Byggtjänst (Swedish Building Services) to address outdated housing projects in Sweden. *See* Carl Manneh, *Minecraft Empowers People to Change Their Block*, MOJANG (Oct. 27, 2011), http://www.mojang.com/2011/10/minecraft-empowers-people-to-change-their-block/.

[72] *See* Robyn M. Dawes et al., *Organizing Groups for Collective Action*, 80 AM. POL. SCI. REV. 1171, 1172 (1986) (describing the successful use of a "money back guarantee device" by The Association of Oregon Faculties in raising the lump sum necessary to hire a lobbyist—"a public good for all faculty members because any pay increases he produced would go to all faculty in the system"). For a recent analysis of the potential uses and limits of such money-back guarantees, see generally Julia Y. Lee, *Gaining Assurances*, 2012 WIS. L. REV. 1137.

[73] *See* Arrow, *supra* note 62, at 9 ("Instead of letting uncertainty ruin existing markets, we can take it explicitly into account by buying and selling commitments to be carried out only if some uncertain event occurs."). Although Arrow uses the example of a "conceivable technological innovation" as the uncertain event, the uncertain event might instead be the collected commitments of a number of other local residents or landowners.

[74] *See* John D. Landis, *A Brave and Better World? The iPad and the Future of Planning*, PLANETIZEN (Feb. 7, 2012, 2:00 PM), http://www.planetizen.com/node/54337 (discussing the possibility that algorithms could eventually perform many of the tasks that planners now perform).

to raise the question of whether ongoing government involvement will be necessary at all. If we understand land use inefficiencies as largely stemming from information failures, and if government involvement serves only as a stand-in for the bargains that would automatically aggregate that information,[75] then efficient information aggregation technologies might appear capable of usurping public land use controls altogether. Might not the dominant form of "post-zoning" land use control be generated by the public at large, once the appropriate (and appropriately crowdsourced) apps have been developed?

Yes and no. It is not hard to predict that emerging technologies will increase the degree to which dispersed information is used in land use decisionmaking. When the cost of an input goes down, more of that input will be demanded, and there is no reason to expect a different result where information is involved. At the same time, governmental entities will retain a critically important role in designing, managing, adapting, and refining appropriately scaled platforms for aggregating and using this information.[76] The discussion below focuses on three facets of this design work: optimizing participation, putting insights from behavioral law and economics to work, and incorporating normative commitments.

A. Optimizing Participation

Crowdsourcing depends on participation. There are three basic challenges in optimizing that participation[77]: deciding who should count as part of the crowd, motivating participation at appropriate levels, and constraining the crowd's influence in ways that are consistent with the local government's normative commitments.[78]

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[75] *See generally* Coase, *supra* note 4.

[76] Other commentators have used and critiqued the "platform" metaphor. *See, e.g.*, Shkabatur, *supra* note 2, at 1460-63.

[77] These considerations, variously enumerated, have appeared in other treatments of crowdsourcing. *See, e.g.*, HOWE, *supra* note 2, at 278-88 (listing ten "rules of crowdsourcing" that include "pick the right crowd" and "offer the right incentives"); Vermeule, *supra* note 6, at 24-38 (noting concerns with "many minds" models in law, including the question of "whose minds," and the need to make "many minds versus other values" tradeoffs).

[78] This third point represents just one way in which information platforms might incorporate normative values; *see also infra* Part II.C.

1. Defining the Crowd

The first set of design questions, tightly connected to questions of scale, is whose participation will be solicited. To begin, we must assume that there is some "deciding jurisdiction" that allows "the crowd's" input to inform whatever land use decision that jurisdiction is contemplating. For example, a municipality might be deciding whether to zone land for low-income housing. An initial question is whether the municipal level offers the appropriate scale for making that land use decision, or whether incentive misalignments are already built into the scale of land use power. In the case of low-income housing, for example, municipalities may attempt to offload fiscal burdens onto neighboring jurisdictions. If such misalignments exist, then improving the technologies through which land use power is exercised may well be counterproductive—unless something else is done to address the underlying problem of scale.

This is not a trivial concern. Land use control is a primary area in which local governments can offload costs onto other jurisdictions and behave in a manner that is detrimental to regional interests. Thus, some types of land use crowdsourcing might work *too well* in communicating self-interested landowner views to local governments, creating political pressure for governmental actors to behave selfishly (or providing an excuse for doing so). Indeed, if one takes a sufficiently pessimistic view of the political economy of land use controls, it would seem better to unmoor land use decisionmaking from the interests of constituents,[79] rather than to tighten those connections through new feedback mechanisms.

There are two responses. The first is that NIMBYism and exclusionary land use policies have historically thrived without smartphones or web interfaces. Homeowner interests were hardly attenuated from or underrepresented in land use policy during the pre-Internet era. This does not tell us whether enhanced participation tools would make matters

[79] Elsewhere I have examined one way of doing so: lowering the stake that homeowners (who tend to be the decisive political actors in most local jurisdictions) have in the portions of their home value attributable to local land use (and other "offsite") decisions. *See generally* Lee Anne Fennell, *Homeownership 2.0*, 102 NW. U. L. REV. 1047 (2008). For further discussion of the political influence and motivations of homeowners, as well as potential responses to homeowner risk aversion (including home equity insurance), see generally FISCHEL, *supra* note 30.

better or worse, but it does suggest something about the baseline from which we are working.

The second response is that new information technologies could offer ways to improve the alignment between inputs to land use decisions and the impacts of those land use decisions. For example, it would be fully possible, and likely desirable, to allow information about particular land use impacts and preferences to flow from similarly situated landowners outside of the jurisdiction. In other words, the inputs used by the deciding jurisdiction need not all originate from within that jurisdiction. Regional information-gathering protocols might be developed to encourage broader-based participation. For example, app users located in adjacent jurisdictions might be allowed to participate in information-gathering initiatives developed by the deciding jurisdiction. Letting the crowd self-define to a degree could capture both extraterritorial impacts and intensities of preferences, and could do so in a manner consistent with the fuzziness of jurisdictional boundaries as they are experienced on the ground.[80]

2. Motivating the Crowd

The question of motivation is also tricky. An initial question is whether people will overcome inertia to participate rather than free-ride on the efforts of others.[81] For many, posting reviews or offering information to a group appears to be its own reward. The willingness of people to become involved in various "citizen scientist" initiatives similarly suggests that the process of gathering data may be engaging in its own right.[82]

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[80] Some creative ideas for restructuring local governance, such as Jerry Frug's suggestion that people be allowed to vote extraterritorially, similarly attempt to blur jurisdictional boundaries. *See* Jerry Frug, *Decentering Decentralization*, 60 U. CHI. L. REV. 253, 323-30 (1993). Broadened participation protocols within a crowdsourcing initiative could offer a nonbinding and less threatening way to experiment along these lines.

[81] *See* Stephenson, *supra* note 2, at 1464-67 (discussing the possibility that the potential benefits of "many minds" will be undermined by weakened incentives to exert effort to obtain high-quality informational signals).

[82] *See, e.g.*, *The Great Backyard Bird Count*, BIRDSOURCE.ORG, http://www.birdsource.org/gbbc (last visited Nov. 14, 2012) (annual four-day birdcounting initiative co-sponsored by the Cornell Lab of Ornithology, the Audubon Society, and Bird Studies Canada); *The Great Sunflower Project*, http://www.greatsunflower.org (last visited Sept. 7, 2012) (backyard bee count to study pollination). These projects are examples of what Yochai Benkler calls "social production," in which unused capacity is effectively donated to collaborative endeavors. Critical to the success of these projects is the property of "modularity"—the ability to break down the project into chunks that can later be successfully aggregated. YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 100-01 (2006). For

Rewards for participation, such as cash payments or lotteries, could also address the problem of underparticipation. Property owners might even be given an incentive through the property tax system to participate in certain data collection initiatives.[83]

Overparticipation might instead be a problem, especially where bits of information submitted by different people are substitutes rather than complements.[84] Information will not be useful if its flow exceeds the receiving entity's capacity to process or respond to it. For example, a recent visit to SeeClickFix revealed unresolved issues within the City of Chicago that were reported months earlier. Real-time reporting would be expected to taper off if users learn that their reports have no effect; hence, it is possible that initial overparticipation, followed by inadequate follow up, will ultimately produce underparticipation. Outfitting feedback mechanisms with "budget constraints" that limit the amount of feedback that any given individual could contribute, or that detect when a duplicate report is being filed, might improve the quality and diversity of contributions and stem concerns about system overload.

3. Controlling the Crowd

A separate issue is that inputs may not be representative or, worse, that they may systematically disregard the interests of less powerful subgroups. The District of Columbia's much-lauded "Apps for Democracy" contest had the ring of good governance about it and indeed seemed to generate useful participatory ideas.[85] Certainly there is something to be said for mechanisms that engage the public and induce participation in governance—and that do so in a

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widespread participation to be feasible, these chunks must be of a manageable size for individuals to contribute; this is the property of "granularity." *See id.*; Benkler, *supra* note 56, at 336.

[83] *Cf.* Larissa Katz, *Governing Through Owners: How and Why Formal Private Property Rights Enhance State Power*, 160 U. PA. L. REV. 2029, 2043-51 (2012) (discussing instances in which the state allocates burdens, like keeping sidewalks free of snow, to private property owners to harness their unique locational advantages).

[84] *See* Stephenson, *supra* note 2, at 1468 ("[T]he impact of dividing research tasks among multiple agents may depend critically on whether the types of information they are charged with producing are substitutes or complements."); *see also id.* at 1467 n.114 (providing a land use planning example in which different pieces of information would be complementary).

[85] *See* APPS FOR DEMOCRACY, http://www.appsfordemocracy.org/ (last visited Sept. 28, 2012) (presenting a platform that local governments can use to run such contests and providing information about the District of Columbia's contest).

way that fits with how people live and work.[86] But the possibility that apps can become *too democratic*, in the sense of privileging majority interests, deserves attention as well. While discussion of participatory interfaces always includes the obligatory reference to the "digital divide," it is not clear that disparities in computer access are ultimately the largest concern. Rather, the worries may largely track those that have been raised in the context of direct democracy: that privileging preference aggregation without deliberation, accountability, or reason-giving could allow some of the most unattractive motivations for policymaking to carry the day.[87]

An example will help to illustrate both the concern and some responses to it. *Gallagher v. Magner*, an Eighth Circuit decision which was recently pending review before the Supreme Court,[88] involved a Fair Housing Act challenge to the housing code enforcement practices of the City of St. Paul. Those practices included a "user-friendly system" that enabled residents to report "problem properties" that should be targeted for code enforcement.[89] If code enforcement was undertaken to make it harder for landlords to offer affordable rental

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[86] Smartphone apps may actually add an element of fun to public participation. At the very least, they are more compatible with people's busy schedules and short attention spans than more traditional means of public engagement, such as attending meetings. *See* ALBERT O. HIRSCHMAN, SHIFTING INVOLVEMENTS: PRIVATE INTEREST AND PUBLIC ACTION 99 (1982) ("That public activities can encroach unduly on the modern citizen's time is well expressed in Oscar Wilde's objection to socialism. It wouldn't work, he said, because it would take too many evenings.").

[87] *See, e.g.*, Julian N. Eule, *Judicial Review of Direct Democracy*, 99 YALE L.J. 1503, 1549 (1990) ("In its substitutive form direct democracy bypasses internal safeguards designed to filter out or negate factionalism, prejudice, tyranny, and self-interest."). Condorcet himself warned of the possibility that prejudices could cause voters to be less than randomly accurate in their opinions, and he said that where this is so, a smaller sample from a more carefully selected group of people would yield better results. CONDORCET, *supra* note 2, at 62. Note, however, that some of the other concerns associated with direct democracy, including problems of sequential decisionmaking, might be alleviated by forms of participation involving more complex scenario-building, where participants can respond to combinations of interlinked elements. *See* Maxwell L. Stearns, *Direct (Anti-) Democracy*, 80 GEO. WASH. L. REV. 311, 361-62 (2012) (giving an example in which the sequence in which different policies are considered proves outcome determinative).

[88] 619 F.3d 823 (8th Cir. 2010), *cert. granted*, 132 S. Ct. 548 (2011), *cert. dismissed*, 132 S. Ct. 1306 (2012). The Supreme Court granted certiorari to decide whether disparate impact claims are cognizable under the Fair Housing Act, and, if so, what test should be applied to them. *Id.* The City of St. Paul, petitioner in the case, withdrew its petition just weeks before oral argument, apparently due to concerns about the potential effects of a ruling eliminating or weakening disparate impact causes of action under the Fair Housing Act. *See* Kevin Diaz, *St. Paul Yanks Housing Fight from High Court*, STAR TRIB. (Feb. 10, 2012, 11:51 PM), http://www.startribune.com/politics/national/139138084.html.

[89] *See Gallagher*, 619 F.3d at 829-30.

properties in the area (as was alleged in *Gallagher*), engaging the public in targeting would be troubling. On the other hand, code enforcement aimed at keeping landlords from shirking on maintenance to the detriment of their tenants would carry a different normative valence. Moreover, wider public participation might ultimately yield enough violation reports within well-off neighborhoods to spark a reassessment and potential recalibration of the stringency of the housing code provisions.

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As this discussion suggests, an important goal of any information platform design initiative must be to engage participation that is appropriately scaled and representative. This will not typically mean maximizing participation, and may indeed require some rationing and gatekeeping. Thus an initial refinement to the open-ended notion of crowdsourcing involves defining and cultivating the crowd. Although getting participation right is crucial to the successful use of new hyperparticipatory technologies, it has always been a crucial (if often ignored) element of successful land use planning and control. The difference is that the new technologies bring the issue front and center, while the older technologies quietly privileged certain interests over others. Rather than viewing new participatory developments as presenting unique threats, they might well be understood as finally clarifying, and rendering more tractable, an aspect of land use planning that has always been significant.

B. Being Behavioral

Engaging in conscious platform design also offers local governments the opportunity to more closely align participation opportunities with the lessons of behavioral law and economics. The NIMBY dynamic that routinely shuts down new development is often associated with risk aversion, but it gains momentum from quirks of human cognition surrounding the valuation of entitlements and the framing of risk. For example, the gap between the price one is willing to pay to acquire an entitlement anew and the price one would demand to give up that same entitlement—whether denominated as an endowment

effect, loss aversion, or status quo bias—could influence the way that existing residents respond to proposed changes.[90]

Land use decisions occur sequentially. Given urbanization trends, most proposed changes involve increases in density or intensity of use. Existing residents largely frame these changes as potential losses. To be sure, these losses may be set against some expected gains (for instance, higher density might promise better infrastructure or improved shopping or dining opportunities), but losses are weighted more heavily than gains. Thus, someone who currently enjoys a bucolic, low-density residential experience might demand a great deal more to give it up than she would pay to acquire it anew from a baseline of a denser residential experience. In addition to perceived asymmetries between gains and losses, consumption of a new residential surround may be an "experience good" whose value is difficult to estimate in advance.[91] Without experiencing a denser, more walkable neighborhood first-hand, for example, people may tend to underrate the benefits, while overrating the advantages associated with an existing low-density environment.

New information platforms offer interesting opportunities to align land use planning more closely with human cognition. Consider loss aversion, which (unlike simple risk aversion) makes reactions to risky outcomes highly sensitive to the reference point from which a change is contemplated.[92] Prospect theory suggests that residents who find the promise of a gain too small to induce them to take on a risk of loss might nonetheless be willing to take on the same amount of risk in the hopes of avoiding a loss.[93] Thus, whether a given change's benefits are framed as a potential gain or as an opportunity to avoid a potential loss could make a significant difference in the

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[90] For an application of the endowment effect to the land use context, see, for example, Georgette C. Poindexter, *Light, Air, or Manhattanization?: Communal Aesthetics in Zoning Central City Real Estate Developments*, 78 B.U. L. REV. 445, 500-02 (1998). An endowment effect is just one possible explanation of the willingness-to-pay/willingness-to-accept gap. *See, e.g.*, Elizabeth Hoffman & Matthew L. Spitzer, *Willingness To Pay vs. Willingness To Accept: Legal and Economic Implications*, 71 WASH. U. L.Q. 59, 85-96 (1993); Daniel Kahneman et al., *Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias*, 5 J. ECON. PERSP., Winter 1991, at 193, 194.

[91] *See generally* Phillip Nelson, *Information and Consumer Behavior*, 78 J. POL. ECON. 311 (1970) (distinguishing goods for which information can be gleaned through search from those for which information must be obtained through experience).

[92] *See* Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA 263, 277-80 (1979).

[93] *See id.* at 268-69.

reception that the change receives.[94] Participatory platforms that simultaneously present land use alternatives for a given area might help to accomplish such a reframing.

One way in which they might do so is by suggesting the risks that nondevelopment poses or, put differently, the options that development of a certain type extinguishes. If one of the benefits of endorsing Development *A* is that it would render impossible Development *B*, a different decision dynamic is presented than if *A* and *B* are presented seriatim as alternatives not to each other, but to the status quo. Emphasizing the property tax implications of particular development alternatives could also reframe a given development choice as one that offers the chance to avoid a painful tax increase. At a more basic level, simply gathering more information about impacts and collecting reports from those who have experienced particular kinds of changes could reduce information shortfalls about the effects of those changes. Doing so can also help to counter loss-averse projections about how future buyers might view a particular change.

New participatory platforms may thus offer more than participation opportunities alone. They may also offer the chance to more actively manage the choice sets that landowners and other constituents confront, and thus the way in which decisions are framed. I do not mean to suggest that engineering the way in which choices are framed is normatively uncontroversial.[95] But it is important to bear in mind that existing land use decisions are made within a default frame that may be distortionary as well. Conscious recognition of the frame and its role will, at the very least, afford greater participation in the question of framing itself.

C. Building In Normative Values

Land use decisionmaking implicates some of the most controversial and important normative questions known to law. To what extent (and at what scale) should racial, ethnic, and socioeconomic integration be pursued, and over whose objections? What patterns of density and space should be sought? How strictly should land uses of different types be

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[94] *See* Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 SCIENCE 453, 456-58 (1981).

[95] *See, e.g.*, Gregory Mitchell, *Libertarian Paternalism Is an Oxymoron*, 99 NW. U. L. REV. 1245, 1248-69 (2005) (critiquing the manipulation of "choice frames" to achieve the results that a social planner views as most welfare-enhancing).

separated? What weights should be placed on factors like security, convenience, and environmental quality? How should locally undesirable land uses be sited? How much should a community's permanence and existing character be privileged over opportunities for growth or increased access for newcomers? Under what circumstances should landowners be forcibly displaced from their homes and businesses?

None of these questions can be answered without reference to facts as they exist on the ground, but neither can they be wholly answered by resort to such facts. At some point, facts run out and normative judgments have to be made. Making such normative judgments is a quintessential, nondelegable duty of government. At the same time, the promise of crowdsourcing lies in its ability to more meaningfully aggregate information—including information about preferences—that can be used to inform normative judgments. Distinguishing value judgments from empirical questions, and maintaining control over the former while outsourcing the latter, represent core challenges for governmental bodies that wish to use new information aggregation platforms.

Using (unfiltered) crowdsourced information as an input into a decision process over which the governmental body retains full control may often be an appropriate alternative. In some instances, however, such a process may frustrate those it means to engage if preferences are expressed for alternatives that turn out to be off the table. The discourse itself may be unproductive or even harmful to the extent that it fails to incorporate the local government's normative commitments. Alternatively, the local government may find its own priorities shifting in response to the political feedback these participatory exercises provide. Again, the anonymity and lack of deliberation associated with atomized inputs into an aggregated system produce real concerns.

Another approach is to build value judgments directly into the interface itself, whether through weightings, side constraints, or otherwise. A proposal by Jonathan Nash and Richard Revesz in the context of emissions trading illustrates one way of approaching the problem.[96] Efficiency gains can be realized through tradable emissions programs, but the fact that

[96] *See* Jonathan Remy Nash & Richard L. Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 ECOLOGY L.Q. 569, 624-61 (2001).

emissions can cause greater or lesser amounts of harm depending on how concentrated or dispersed they are in time and space presents a central design difficulty. Nash and Revesz suggested a website "preclearance" process that would block problematic emissions transactions while permitting other transactions to occur.[97] Likewise, we can imagine interfaces that would allow users to register land use preferences (or engage in transactions based upon them) within a normatively constrained space.

Here, we can learn from computer programs that have already been used to augment land use planning. Nearly fifteen years ago, Elise Bright detailed the operation of one such program, "A Land Location and Optimization Technique" (ALLOT).[98] This computer model constructs "'optimum' future land use patterns" by combining a GIS-based system for finding suitable sites with land use demand predictions.[99] What makes the system uniquely applicable to the discussion here is its ability to build social objectives and legal constraints into the weightings that are used.[100] Such a program illustrates how local governmental units can retain their roles in setting normative desiderata, while still allowing room for algorithm- and data-driven optimization within the stated parameters. It also shows how the constraints themselves may reflect empirically questionable assumptions.

For example, in one of the studies undertaken using the ALLOT model, "the community had a strong preference for low-density, single-family residential development in undeveloped areas, with multi-family housing confined to areas close to the highway or to existing commercial nodes."[101] Based on the opinion of "legal experts," the model also assumed

> that aircraft noise must be treated as a "knockout factor": that is, if high noise levels were present, then a pixel simply could not be selected for residential use no matter how suitable it might be in

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[97] *See id.* at 624-28.

[98] Elise Bright, *Using the "ALLOT" Model in Land Use Decision-Making*, *in* DECISION SUPPORT SYSTEMS IN URBAN PLANNING 229 (Harry Timmermans ed., 1997). The then-state-of-the-art technology that Bright describes has no doubt become quite dated in the intervening years. Nonetheless, the level of detail provided by the author makes this a helpfully concrete example to use in thinking through the role of local governments in managing and deploying information.

[99] *Id.*

[100] *See id.* at 236.

[101] *Id.*

> every other way; the legal consequences of allowing residential development in these areas would be too severe.[102]

While less normatively charged than the preference for single-family dwellings, the assumptions about airport noise also raise empirical questions that a more thoroughly "crowdsourced" style of land use control might be well equipped to address: the value attributed to quiet, the degree of disruption from a given noise level, the actual noise levels involved, and the ability to buffer them through soundproofing or other means.

The government's role as a platform designer should be taken seriously. Some decisions are too important or sensitive, or too closely related to the protection of minority interests to "crowdsource." At the same time, the government should not be too quick to take off the crowdsourcing table information about actual impacts that could influence the views of "the crowd." Unstated empirical assumptions already frequently form unacknowledged parts of political judgments. Recognizing whether disagreements are fundamentally about values or about empirics is central to designing information-harnessing platforms that will represent improvements over the status quo.

Special challenges are presented by forms of information that can influence and entrench land use patterns simply by being disseminated. For example, Microsoft's "Pedestrian Route Production" app has fallen under criticism for offering an algorithm that (according to the patent application) can "tak[e] the user through neighborhoods with violent crime statistics below a certain threshold."[103] Similarly, the ASROmeter app provides information within England and Wales about "anti-social behavior" in the nearby environment. Both apps draw on public crime data, but as users respond to the cues—withdrawing from "dangerous" areas and frequenting "safe" ones—they may influence the data that will be generated in later periods.[104] These data, and their

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[102] *Id.*

[103] U.S. Patent No. 20,090,157,302 [0035] (filed Dec. 14, 2007), *available at* http://appft.uspto.gov/netahtml/PTO/srchnum.html (search "20090157302"); *see also* Allison Keyes, *This App was Made for Walking—But Is it Racist?*, NPR.org (Jan. 25, 2012), http://m.npr.org/story/145337346?url=/2012/01/25/145337346/this-app-was-made-for-walking-but-is-it-racist.

[104] This connects to the concern about "herding" that is sometimes associated with sequential as opposed to simultaneous contributions of information. *See* Stephenson *supra* note 2, at 1474-76; *see also id.* at 1476-79 (discussing additional complications with sequential decisionmaking when information acquisition is endogenous).

dissemination, may also impact residential decisions, triggering additional responses.[105]

Does this suggest that government should also play a role in cloaking information, as well as in eliciting and sharing it?[106] Such a cure may be worse than the disease. Suppressing data is likely to be ineffectual as well, given the ability of users to generate and share their own information. A better approach may be to use this same information to counteract the self-reinforcing cycle, as by directing more resources to areas that are skirted by the Pedestrian Route Production app. It should also be emphasized that the vicious cycles that might be prompted by certain kinds of information—and efforts to short-circuit them—are nothing new. In an earlier era, "blockbusters" attempted to use (or manufacture) information about plans and intentions to intentionally destabilize neighborhoods.[107] Communities trying to maintain neighborhoods against the threat of "white flight" attempted to suppress informational signals in the form of "for sale" signs, lest those signals contribute to more such signals. When these efforts ran aground for constitutional reasons,[108] communities had to find new ways to arrest self-reinforcing dynamics. New technologies may heighten the need for such solutions, but they may also contribute to their formulation.

CONCLUSION

Information is a key input into land use controls, but it has historically been expensive to obtain and difficult to use. Technological advances have reduced the cost of collecting and aggregating information, while theoretical advances have increased the potential benefits that might be derived from employing those aggregations. The time is ripe for rethinking the role that dispersed information can play in land use policy. To that end, local governments should explore new ways of crowdsourcing land use.

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[105] *See, e.g.*, SCHELLING, *supra* note 63, at 146-47 (observing that residential changes may set in motion further moves).

[106] *Cf.* STRAHILEVITZ, *supra* note 39, at 157-58 (observing that the government may at times use "curtains" to obscure information about certain characteristics).

[107] *See, e.g.*, AMANDA I. SELIGMAN, BLOCK BY BLOCK: NEIGHBORHOODS AND PUBLIC POLICY ON CHICAGO'S WEST SIDE 151-62 (2005); Dmitri Mehlhorn, *A Requiem for Blockbusting: Law, Economics, and Race-Based Real Estate Speculation*, 67 FORDHAM L. REV. 1145 (1998).

[108] *See* Linmark Assoc. v. Twp. of Willingboro, 431 U.S. 85 (1977) (striking down a ban on "for sale" and "sold" signs).

Crowdsourcing, as I use the idea here, is not the same thing as delegation or abdication. The point is not to turn over land use authority outright to the public, but rather to find better ways to elicit, aggregate, coordinate, and channel the preferences, intentions, and experiences of current and future land-users. Zoners and planners must begin shifting their focus from the top-down regulation of land use to the development of information platforms for coordinating land use. These platforms, however, must be appropriately scaled and normatively constrained. Slick new apps and fancy websites undoubtedly will be part of the future of land use control—but only part. The right theoretical and institutional foundations are also necessary. Here, I hope to have made a start at specifying those foundations.